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Examining the Potential for Population Growth and an Economic Boom in Elk Creek, Nebraska as a Result of Mining

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EXAMINING THE POTENTIAL FOR POPULATION GROWTH AND AN ECONOMIC BOOM IN ELK CREEK, NEBRASKA AS A RESULT OF MINING

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EXAMINING THE POTENTIAL FOR POPULATION GROWTH AND A BOOM IN ELK CREEK, NEBRASKA AS A RESULT OF MINING

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Many communities throughout the world that rely on resource extraction experience a population boom. This boom can be difficult accommodate due to the fact that many of these communities are small and do not have the housing to deal with the population increase. Elk Creek, Nebraska, a small community in southeast Nebraska, is on the brink of experiencing a possible boom situation. A company called NioCorp has discovered a mineralization at a site near the community and plans to mine niobium, titanium, and scandium from it. They believe this will add 1,200 temporary jobs for construction and 300 to 400 permanent jobs to the area. The purpose of this study is to determine possible solutions for Elk Creek in different scenarios of population increase based upon the experiences of other boom communities. The findings reveal that temporary housing will be needed for the construction workers, while permanent housing will be needed for the permanent mine employees. The study finds that it would benefit Elk Creek to work on integrating the people into the community and implementing more permanent housing in the event that more people move to the community. This would allow them to integrate faster and build up industries that are not dependent on the mine in the case of a boom. Smaller population increases allow for slower integration and

slower construction of permanent housing. Ultimately planning and regional cooperation is needed in Elk Creek and other nearby communities prior to the population increase in order to ensure the communities do not suffer negatively because of it.

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ABSTRACT

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Chapter 1: Introduction

Boom communities hold a significant place in the history of the United States. From the gold rush communities of the 1800s to the more recent rapid growth in the oil communities in North Dakota, boomtowns have been present, not just during the development of the country, but into today. These communities are often associated with resource extraction and can offer many job opportunities to those willing to move there. However, boom communities do not come without problems. A major increase in population in a short amount of time can lead to situations where the town's population grows faster than the community can cope with in terms of housing and infrastructure. This situation has presented itself recently in the oil field towns of North Dakota. In the event that a community has the potential to become a boomtown, it is important to understand the problems that may occur within them and plan for those issues so they do not become detrimental to the future of the community.

Ronald L. Little (1977) explains the phenomenon of boomtowns in his article, "Some Social Consequences of Boom Towns." He mentions that they often experience annual rates of population growth between 10% and 15% and are often associated with mining or the extraction of resources. At the time Little's article was written, the materials extracted in boomtowns included coal, oil, and uranium (Little, 1977). The author also mentions that boomtowns are often small, rural communities rather than areas with large populations. He states that "Because the breakdown of local community services and structures can be attributed to unusually high population growth rates, it follows that boom conditions will seldom be found in large metropolitan areas. Even a

new industry that would add 20,000 persons to a large urban community such as Chicago would be unlikely to strain the existing social structures," (Little, 1977, pp. 402-403).

One way to interpret Little's (1977) statements is that while boomtowns may have a smaller population increase than a larger city does, the nature of a boomtown is one in which the town does not have the existing infrastructure to incorporate the population influx immediately. Based upon general observation, this seems to be the case. We often do not hear about large increases in the populations of major cities. This type of population increase in these cities is normal. Large cities are often continually growing. They have the infrastructure to deal with this growth and if they do not, they may have the resources to expeditiously improve their infrastructure. However, large population changes in small communities draw a lot of attention. It is more noticeable in these communities, and people from outside may begin to wonder why others are moving to this small, rural town with seemingly nothing there. As Little (1977) states, these increases are newsworthy because many small towns do not have the infrastructure to withstand a major population increase. Little (1977) also mentions that the population increase is accompanied by economic growth. People move into the area in order to take advantage of the booming economy. The author also states that it is important to plan for this growth in these types of communities in order to prevent the issues often associated with boomtowns (Little, 1977).

John S. Gilmore (1976) indicates that the attitude of the people in a boomtown goes through four phases. Those phases are "enthusiasm," "uncertainty," "near panic," and "a problem solving attitude" (Gilmore, 1976, p. 536). While examining these phases, we can see that the enthusiasm phase comes with the promise of increased wealth for the community. The uncertainty phase is over how much population growth there will be

and what will be needed to handle it. The third phase is the realization that the community may not be able to handle the growth smoothly. The fourth phase is finding solutions to the problems that occur (Gilmore, 1976). Gilmore mentions that "the more information that is available on prospective change, the sooner the fourth phase comes," (Gilmore, 1976, p. 536). This means that the more preparation that is done ahead of a boom, the easier it is to come up with solutions faster. For example, if research is completed and an estimate of the number of people expected to move to the community as a result of the boom is reached, then it is much easier to find quicker solutions to problems with housing shortages that may arise. This is why it is important for boom communities to be proactive and try to fix the problems that arise as early as possible, or better yet, before they occur.

An article written by Doukas, Cretney, & Vadgama (2008) indicates that mineral extraction boom towns experience both a boom and a bust. The bust occurs because the mineral prices drop. The temporary workers leave and the production may halt. The article also states that it is hard to know exactly when the prices are going to be at their highs and lows (Doukas, Cretney, & Vadgama, 2008). For example, Jeffrey City, Wyoming was a uranium mining town during the cold war. Michael A. Amundson states that "like most mining towns, Jeffrey City's future was dependent on two factors: its resource base and market," (Amundson, 1995, p. 491). In other words, the community would continue to exist as long as it did not run out of the resource it mined, and the market for that resource remained strong. Jeffrey city's market for uranium eventually disappeared "because it had never diversified beyond its uranium dependency," (Amundson, 1995, p. 492). Therefore, it is important for a boom community to do what they can to set themselves up for economic success in the event of a bust.

Elk Creek, Nebraska is a community on the possible verge of a resource boom. NioCorp Developments Ltd. is looking to develop a mine, which would add a great number of jobs to the area. However, Elk Creek is a very small community, fitting Little's (1977) description of a potential boom town. Since the mine will not be built for several years, Elk Creek has the opportunity to plan ahead so they do not experience Gilmore's (1976) middle two phases. In order to do so at such an early juncture, it is easier to determine what might happen based upon data and what has happened in other modern boomtowns. The purpose of this paper is to derive some general housing related scenarios that Elk Creek might experience as a result of a mine being introduced into the community. This paper will attempt to answer the following questions.

- What kind of population growth is likely to occur?
- What does the current housing base stock look like for Elk Creek?
- What lessons in terms of housing, can be learned from recent boomtown experiences in North Dakota?
- What lessons, in terms of housing, can be learned from recent boomtown experiences outside of North Dakota?
- What type of housing has been implemented in recent North Dakota boomtowns?
- What could be an expected housing scenario for Elk Creek, based on experiences in North Dakota?
- How can housing used in other circumstances, such as emergency situations be applied to a boom situation?
- What type of housing might be best for Elk Creek to incorporate in the event of a boom?

Chapter 2: Background of NioCorp and Elk Creek

2.1 NioCorp

Elk Creek is closer to the project site than any other town in the area (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). The site is located about three miles from Elk Creek. The site was first scanned using three different airborne magnetic surveys. These were completed by the U.S. Geological Survey in 1963 and 1964. Therefore, findings at the Elk Creek site appeared in 1970 when the University of Nebraska – Lincoln (UNL) Conservation and Survey Division (CSD) completed "a reconnaissance gravity geophysical survey of southeast Nebraska" (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015, p. 34). In 1971, the Nebraska Geological Survey (NGS) came across the Elk Creek Carbonatite when they and the United States Bureau of Mines (USBM) drilled test hole in the Elk Creek area (SRK Consulting, Inc., and Roche, Ltd., Consulting Group, 2015).

The report by SRK Consulting, Inc., and Roche Ltd., Consulting Group (2015) states that it is not clear when the mineral rights to the land were first obtained. However, they believe that a company called Comico American and another company called Molycorp both had rights over sections of the land at the same time. This would have been between 1971 and 1973. Molycorp drilled at the site several times from 1973 to 1986 and commissioned aeromagnetic surveys in 1973 and 1980 through Olympus Aerial Surveys Inc. Molycorp discovered the Niobium at the site (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). The report by SRK Consulting, Inc., and Roche Ltd., Consulting Group states that "Between 1984 and 2010 at an unknown date, the title of the Project was held by Elk Creek Resources Corp. (ECRC)," (SRK

Consulting, Inc., and Roche Ltd., Consulting Group, 2015, p. 33). This company became a subsidiary of Quantum Rare Earth Developments Corp. in 2010. This is the company that today is known as NioCorp Developments Ltd. (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). The name change occurred in 2013. Today, "the Property consists of 21 option agreements covering approximately 1,796 hectares (ha), of which the Company currently hold 15 active agreements (1,216 ha), with the remaining 7 option agreements currently undergoing re-negotiation. Option agreements are between NioCorp's subsidiary Elk Creek Resources Corp (ECRC) and the individual land owners" (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015, p. 1). Drilling had been completed by companies who owned the mineral rights prior to NioCorp. However, in 2014, NioCorp conducted their own drilling program with the "aim of increasing the confidence in the 2012 Mineral Resource Estimate from Inferred to Indicated," (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015, p. 62). In other words, the holes were drilled in order to obtain a better understanding of the minerals in the deposit and how much was there. A photo of one of the drill hole sites can be found in Figure 1(p. 7).

Going forward, a Feasibility Study will be completed in 2016 (NioCorp Superalloy Materials, n.d.). When the study is completed, the company will need to raise money before they can begin construction of the mine (Bergin, 2016b). The initial capital costs needed for the project add up to $978,742,000 (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). The construction could begin in 2016. However, the company has not indicated how much money they need to raise before they are ready to begin construction (Bergin, 2016b). The Preliminary Economic Assessment created by SRK Consulting, Inc., and Roche Ltd., Consulting Group (2015), indicates that the

Figure 1 NioCorp Drill Site in Johnson County, Nebraska

Source: (Bogle, 2016g)

construction on the underground mine might begin in June of 2016. However, comments from an interview with the Vice President of External Affairs for NioCorp indicate that mining may not even begin until 2017 (J. Sims, personal communication, February 16, 2016). The company hopes to begin production in 2018 after a commissioning period (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015).

The mine will produce three commodities. These include niobium, in the form of ferroniobium (FeNb), scandium, in the form of scandium oxide ($Sc_2O_{3)}$, and a by-product of titanium in the form of titanium dioxide (TiO_2) (SRK Consulting, Inc., and Roche Ltd.,

Consulting Group, 2015). Niobium is often sold as ferroniobium, as an ore, or as an oxide (Papp, 2015). Ferroniobium is used to create high strength low-alloy (HSLA) steel. The price of niobium is affected by how available it is (Papp, 2013). Several events have affected the price over time. In the 1950s, the prices rose due to the United States beginning to buy it. In the 1960s, it was discovered that niobium could be used to strengthen steel. In the 1970s, the price increased again due to an increase in demand. Niobium oxide and high-purity niobium prices lowered in the 1980s. This was due to the opening of plants in Brazil and the United States that create niobium oxide from pyrochlore material (Papp, 2013). In 1998, an effort to keep up with the growing demand of ferroniobium was launched. A company in Brazil, the country producing the most niobium at the time, made plans to produce 50% more ferroniobium by the year 2000 (Papp, 2013). As of 2016, the leading producer in the world was Brazil at about 90%. Canada was second at about 9% (Papp, 2016). Since Brazil produces most of the niobium produced in the entire world, they have been able to keep the prices fairly steady (Papp, 2013).

Scandium is classified as a rare-earth metal. It is typically used in fuel cells. It is also used to create and alloy with aluminum (Gambogi, 2016). Only about 10 to 15 tons of scandium are used in the world each year (Gambogi, 2016). Titanium mineral concentrates are used in the form of pigments in paint, paper, and plastics (Bedinger, 2016b). According to Joseph Gambogi (2013), it is used by the military and in aerospace applications. Prices have changed a great deal over the years. The high price was 1981. Moving to more modern dates, the price decreased in 2002 due to the September 11 terrorist attacks. Prices began to rise from 2004 to 2008 due to an increase in aerospace production. In 2008, the economy caused the price to lower, which continued into 2010

(Gambogi, 2013). The leading producer of the titanium concentrate ilmenite in 2014 was China, followed by Australia, South Africa, Vietnam, Mozambique, and many other countries. The leading producer of the titanium concentrate rutile in 2014 was the United States, followed by Sierra Leone, Ukraine, South Africa, Kenya and a few other countries (Bedinger, 2016b). The leading producer of titanium sponge in 2014, as reported, was China, followed by Russia, Japan, Kazakhstan, Ukraine, and other countries (Bedinger, 2016a).

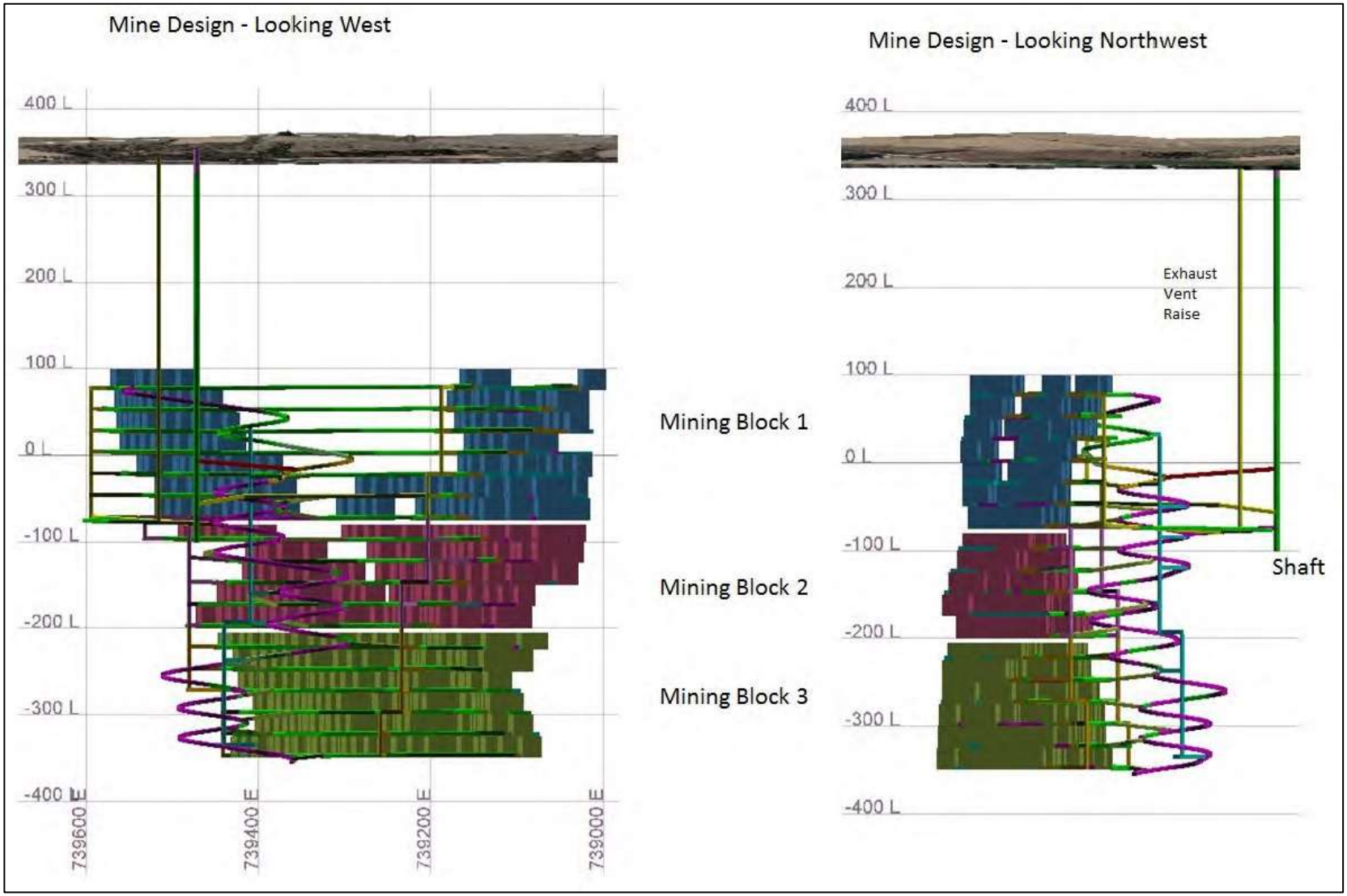
A document, called The Preliminary Economic Assessment, was created for NioCorp by SRK Consulting Inc., and Roche Ltd., Consulting Group (2015) to offer preliminary estimates of the items to be mined as well as preliminary mine plans. The Preliminary Economic Assessment indicates that the average production of ferroniobium will at the Elk Creek mine would be about 7,500 metric tons per year (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). Scandium oxide will be produced at a rate of about 97 metric tons per year. Titanium dioxide will be produced at a rate of about 24,000 metric tons per year (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). The mine is scheduled to produce for 32 years with production beginning in 2018 (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). The deposit is larger than what will be mined. The Preliminary Economic Assessment indicates that "The deposit remains open both along strike to the northwest and southeast and at depth" (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015, p. 282). Laurynas Vegys, (2015) a research analyst at Casey Research explains that when a deposit is open along a strike, it means that the deposit limits have not been found yet through test drilling. This means that the limits of the Elk Creek deposit have not been found through drilling to the northwest and southeast of the current known deposit. In addition, the

limits of the deposit are not known deeper into the ground below the current known deposit.

The mine will use an underground method of mining called longhole stoping. A shaft, or the main hole for transportation between the surface and the underground portion, will be built first. This shaft will be 435 meters deep with a diameter of 7.5 meters. The mine will be divided into three blocks, and each block will be divided into levels (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). Stopes, or holes that the minerals will be mined from, will be constructed in the levels. A ramp will connect these levels together. These stopes, of which there will be 20 to 30 per level, will be 25 meters tall and 15 meters in width (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). When mining at a stope is finished, it will be filled in with backfill. This will consist of fly ash and sand. The fly ash will come from coal power plants in southeast Nebraska. A small amount of cement will be used in the backfill material as well (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). A diagram of the future mine is found in Figure 2 (p. 11).

The processing of ore at the NioCorp plant will require a facility for breaking up material so the minerals can be extracted from the ore, a hydrometallurgical plant, and a pyrometallurgical plant (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). The hydrometallurgical plant will be used to remove oxides of the three commodities from the material in which they are found. These include niobium pentoxide, scandium oxide, and titanium dioxide (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). In addition, a facility aimed at storing the waste rock after the minerals are extracted from it, called tailings, is to be included at the site (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). Other facilities will also be built on the site.

Figure 2 **Completed Mine Design**



Source: (SRK Consulting, Inc., 2015), Adapted from (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015, p. 183)

NioCorp expects the project to add jobs to the area. The mine is expected to offer up to around 1,200 construction jobs at the height of the construction period. This construction period will begin with a smaller number of construction workers, will increase, and then decrease towards the end of construction (J. Sims, personal communication, February 16, 2016). At a March 16, 2016 town hall meeting at a meeting place near Tecumseh, Nebraska, NioCorp representatives mentioned that permanent jobs could number 300 to 400 (Bergin, 2016a). This could provide the economic opportunities for local people because the company has indicated the desire to hire and train local people (J. Sims, personal communication, 2016). The Preliminary Economic Assessment indicates that the area contains a "local work force including heavy equipment operators" (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015, p. 1).

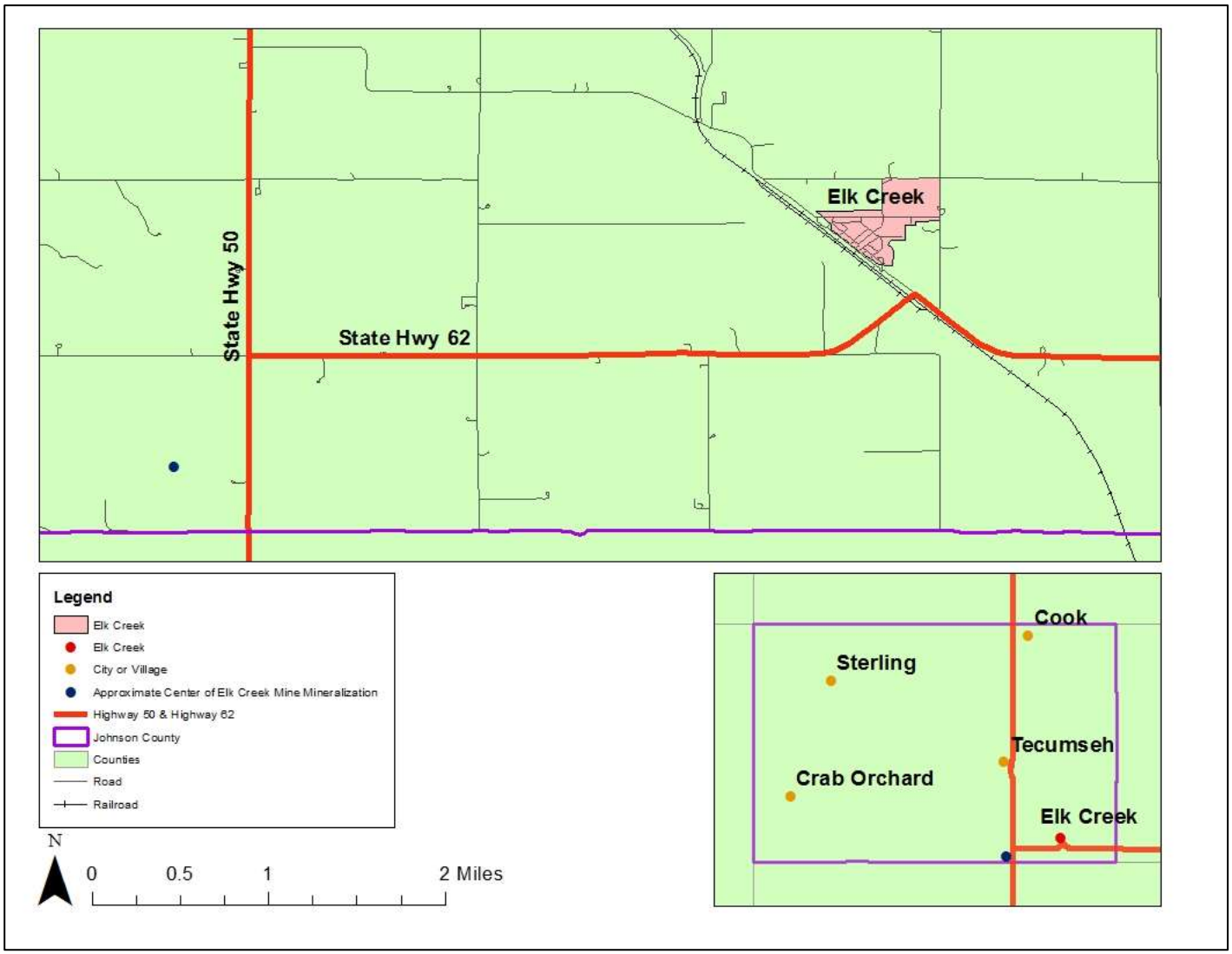
The Preliminary Economic Assessment indicates a peak number of 219 people for the operation of the mine (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). This number is based upon a rotation of crews in the mine. According to the assessment, the manpower needed will be "using an operating schedule consisting of 12 hours per shift, two shifts per day, and seven days per week. The 12 hour shift is supported by a four crew rotation. The management and technical team are planned to work five 8-hour days per week" (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015, p. 201). However, this number seems to be low based on recent statements from company representatives. In addition, IAMGOLD, the company that owned the Niobec niobium mine in Canada, announced on April 23, 2012 the results of a prefeasibility study they completed. In that press release, the company indicated that they would be moving to a block caving mining method to increase production. This was

expected to add 200 jobs to the 400 jobs they already offered (Mine Niobec, 2012). The company used a stope method previously, and sometime after 2009, moved to a stoping method with backfill, as opposed to one without (IAMGOLD Corporation, 2009). The mine has since been sold by IAMGOLD to Magris Resources (Mine Niobec, 2015). Niobec used a mining method similar to what NioCorp will use, while employing around 400 people. Therefore, it is possible that NioCorp could employ a similar number of employees.

2.2 Elk Creek

Elk Creek, Nebraska is a rural community that fits the criteria for identifying a possible boomtown outlined by Little (1977). Located in Johnson County in southeastern Nebraska, the town has a population of 98 as of the 2010 Census (U.S. Census Bureau, 2010e). It is located about three miles from the approximate center of the mineralization listed in the Preliminary Economic Assessment of 40°16'3.5" N and 96°11'8.5" W (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). This location is a little over 3 miles southwest of Elk Creek. Although the nearest intersection to these coordinates is that of Nebraska Highway 50 and 720 Road, the nearest major intersection is that of Nebraska Highway 50 and Nebraska Highway 62. Much of the construction of the site will be in the portion of land to the southwest of this intersection (S. Honan, personal communication, February 18, 2016). This section of land, owned by more than one person or family, is surrounded by Nebraska Highway 50 to the east, 720 Road to the south, 620 Avenue to the west, and 721 Road to the north. Figure 3 (p. 14) shows the location of the approximate center of the mineralization and the location of Elk Creek. NioCorp has or is negotiating surface and/or mineral rights of several other sections of

Figure 3 **Location of Elk Creek, Nebraska and Future Elk Creek Mine Site**



Source: (2014 TIGER/Line Shapefiles (machine-readable data files) / prepared by the U.S. Census Bureau, 2014; 2015 TIGER/Line Shapefiles (machine-readable data files) / prepared by the U.S. Census Bureau, 2015)

land, many surrounding this area (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). Upon a visit to Elk Creek, it is easy to see why adding 300 or 400 jobs to the area might be a problem for a community of this size. The town consists of a farmers' co-op, and a one-street downtown with a post office, a bank, a grocery store, a bar, and a few other businesses, as well as an empty school up on a hill. A few residential streets and two parks surround the downtown street to the northwest, north, and southeast. Photos of various buildings and houses in of Elk Creek can be found in Figure 4, Figure 5 (p. 16), Figure 6 (p. 16), Figure 7 (p. 16), and Figure 8 (p. 17).

As previously mentioned, Elk Creek is located in the southeastern portion of Johnson County. The population of the county, as of the 2010 Census, was 5,217 (U.S. Census Bureau, 2010h). Towns listed on the Johnson County government website as communities located in the county include Cook, Crab Orchard, Elk Creek, Sterling, St. Mary, and Tecumseh (About Johnson County, n.d.). Vesta is another community located

Figure 4 **Downtown Elk Creek**

Source: (Bogle, 2016b)

Figure 5 Jefferson Street – Residential Street in Elk Creek, Nebraska

Source: (Bogle, 2016d)

Figure 6 Main Street – Elk Creek, Nebraska

Source: (Bogle, 2016e)

Figure 7 Single-family House in Elk Creek, Nebraska

Source: (Bogle, 2016h)

Figure 8 **Mobile Home in Elk Creek, Nebraska**

Source: (Bogle, 2016f)

Table 1 Populations of Nebraska Communities Near Elk Creek, Nebraska

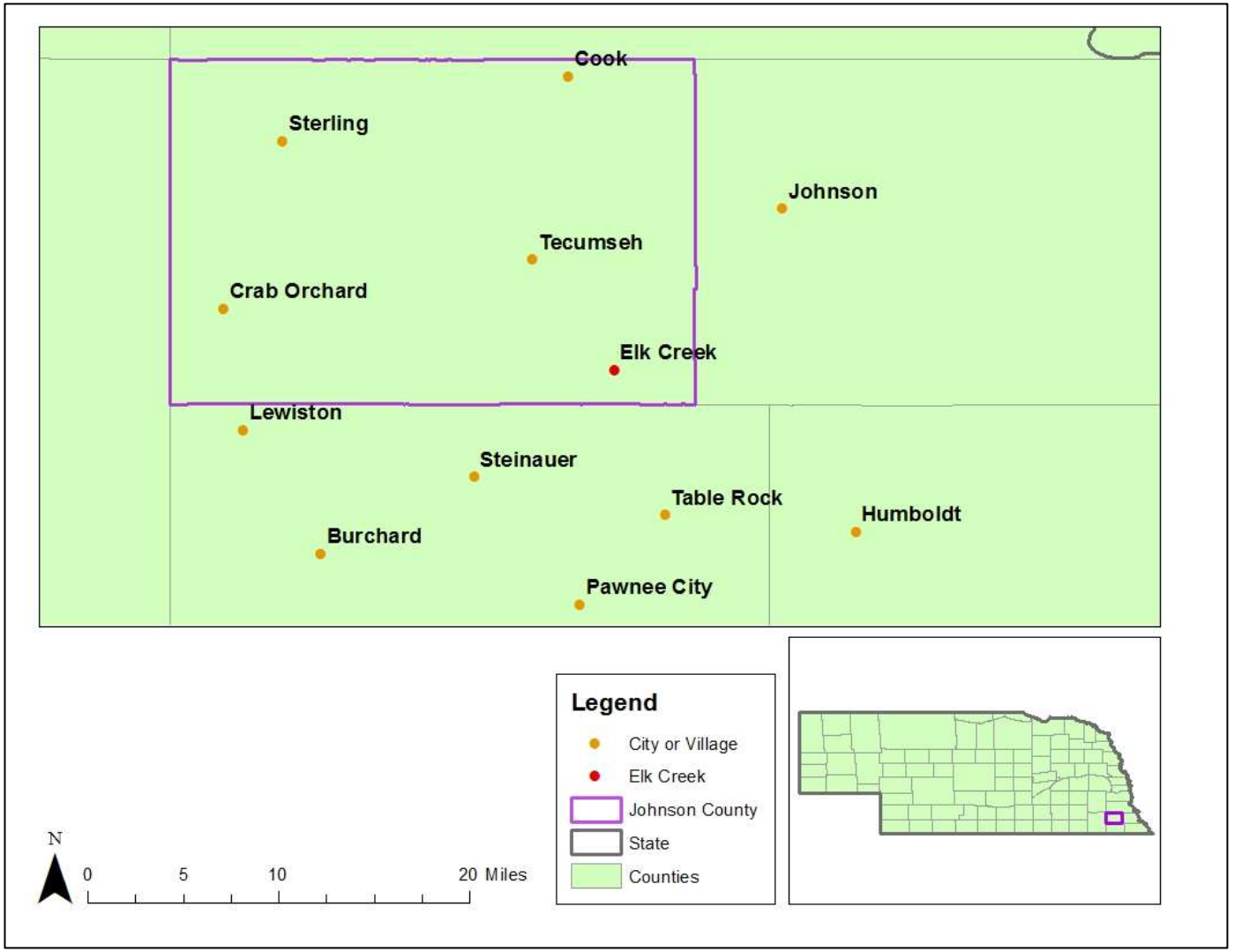
Community	Population	County
Burchard	82	Pawnee
Cook	321	Johnson
Crab Orchard	38	Johnson
Elk Creek	98	Johnson
Humboldt	877	Richardson
Johnson	328	Nemaha
Lewiston	68	Pawnee
Pawnee City	878	Pawnee
Rohrs	Unincorporated	Nemaha
St. Mary	Unincorporated	Johnson
Steinauer	75	Pawnee
Sterling	476	Johnson
Table Rock	269	Pawnee
Tecumseh	1,677	Johnson
Vesta	Unincorporated	Johnson

Sources: (U.S. Census Bureau, 2010b; U.S. Census Bureau, 2010c; U.S. Census Bureau, 2010d; U.S. Census Bureau, 2010e; Census Bureau, 2010f U.S. Census Bureau, 2010g; U.S. Census Bureau, 2010h; U.S. Census Bureau, 2010i; U.S. Census Bureau, 2010j; U.S. Census Bureau, 2010k; U.S. Census Bureau, 2010l; U.S. Census Bureau, 2010m; U.S. Census Bureau, 2010n)

in the county that is not listed on the Johnson County website. Other Nebraska communities near Elk Creek include; Burchard, Humboldt, Johnson, Lewiston, Pawnee City, Rohrs, Steinauer, and Table Rock. These 2010 populations of all communities listed can be found in Table 1 (p. 17). A map of southeast Nebraska and the incorporated communities located near Elk Creek is found in Figure 9 (p. 19) with the marker for Elk Creek in red and markers for other communities in orange.

Elk Creek has a joint comprehensive plan with the county and one other community titled *Johnson County Crab Orchard and Elk Creek Comprehensive Development Plan Zoning and Subdivision Regulations*. It was adopted in 2001 and was written by Stahr & Associates Community and County Planning Associates and JEO Consulting Group, Inc. The plan uses a planning horizon of 20 years from 2001 to 2021 (Stahr & Associates Community and County Planning Associates and JEO Consulting Group, Inc., 2000). According to the comprehensive plan, water is provided to Elk Creek in two different ways. The village has its own well, but also buys water from the Johnson County Rural Water District #1(Stahr & Associates Community and County Planning Associates and JEO Consulting Group, Inc., 2000). The comprehensive plan indicates that the Johnson County Rural Water District obtains its water for the eastern portion of the county from Tecumseh. Elk Creek obtains water from the village well at a rate of 50 gallons per minute, as well as no less than 80,000 gallons per month from the rural water district. The 80,000 gallons are consumed first, with the rest of the water needed for a particular month provided by the local well (Stahr & Associates Community and County Planning Associates and JEO Consulting Group, Inc., 2000). In addition, the village also has a 35,000 gallon water tower for storage. The plan indicates that if the per capita rate

Figure 9 **Locations of Nebraska Communities near Elk Creek, Nebraska**



Source: (2014 TIGER/Line Shapefiles (machine-readable data files) / prepared by the U.S. Census Bureau, 2014; 2015 TIGER/Line Shapefiles (machine-readable data files) / prepared by the U.S. Census Bureau, 2015)

of water usage per day is 150 gallons, then a population of 497 people could be served (Stahr & Associates Community and County Planning Associates and JEO Consulting Group, Inc., 2000). However, the plan also states that more water may be needed if more demand is observed. This could be done by adding community wells or buying more water from the rural water district. It should also be noted that the amount of water used from the local well is unknown because the village does not keep track of that (Stahr & Associates Community and County Planning Associates and JEO Consulting Group, Inc., 2000). This means that more water may be needed if the well cannot meet demand.

Another problem with the water system is the fact that it is not capable of being used to fight fires. This could become a problem if substantial growth warrants the need for better fire protection. The plan states that the best place for distribution expansion is the north and east portions of the community (Stahr & Associates Community and County Planning Associates and JEO Consulting Group, Inc., 2000).

A complete-retention lagoon is used for wastewater treatment and contains two lagoon cells, but no storm drains are present in the community (Stahr & Associates Community and County Planning Associates and JEO Consulting Group, Inc., 2000). If sewage expansion is needed, it must also be done to the north and east. The plan states that "extensive expansion of the system would require examination of the capacity of complete retention lagoon system" (Stahr & Associates Community and County Planning Associates and JEO Consulting Group, Inc., 2000, p. 76). This means that that if more sewage is collected, the lagoon may not have the capacity for it, but that needs to be further examined, to be sure.

Electricity is distributed using a village-owned distribution center, but is provided by the Omaha Public Power District (OPPD) (Stahr & Associates Community and

County Planning Associates and JEO Consulting Group, Inc., 2000). The plan states that "supply appears to be adequate at this time and it is believed that future demand will be met as development occurs" (Stahr & Associates Community and County Planning Associates and JEO Consulting Group, Inc., 2000, p. 77).

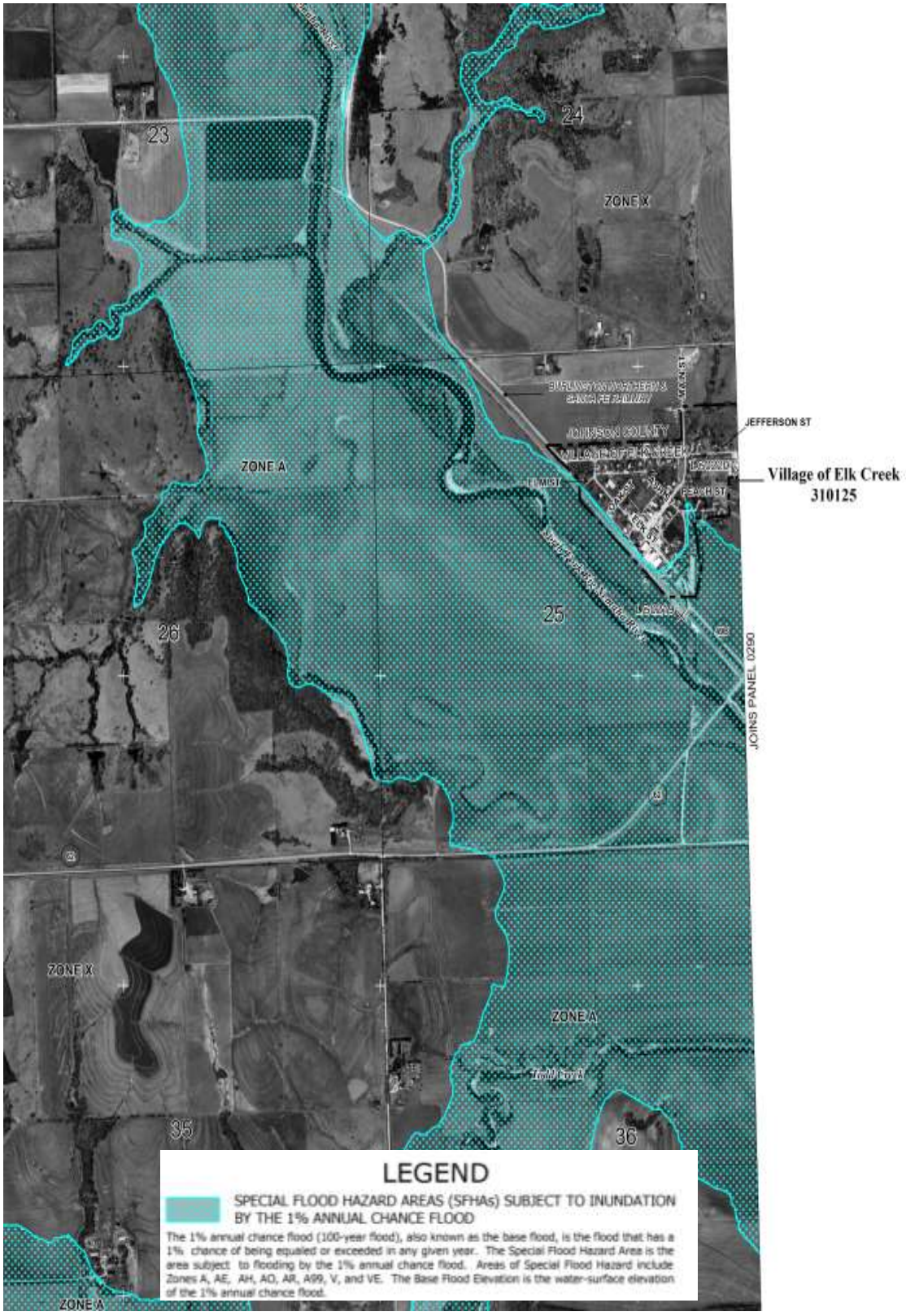
The comprehensive plan lists several goals for future development in Johnson County. One is to "maintain quality housing opportunities within the rural portions of Johnson County and provide for development of limited additional housing in the rural portions of the County" (Stahr & Associates Community and County Planning Associates and JEO Consulting Group, Inc., 2000, p. 82). Another goal indicates that the county should "minimize the potential for increased conflicts between land uses in the rural portions of Johnson County," (Stahr & Associates Community and County Planning Associates and JEO Consulting Group, Inc., 2000, p. 83). The descriptions of the objectives of the two goals indicate a desire for limiting the removal of profitable farmland and encouraging the future development of housing near already developed areas of the county, such as villages. As the second goal listed above states, this is to limit the conflict between agricultural and residential uses, as well as to limit the need of the county to stretch the provision of infrastructure or other services too thin.

The soils near Elk Creek limit the areas available to future expansion due to flooding and the slope of the land. This is, in part, due to their proximity to the North Fork of the Big Nemaha River. The areas with the least accommodating soils are to the southeast, southwest, and west of the village (Stahr & Associates Community and County Planning Associates and JEO Consulting Group, Inc., 2000). The plan indicates that within the corporate limits of Elk Creek, "agricultural/vacant/undeveloped land within Elk Creek is quite extensive," (Stahr & Associates Community and County Planning

Associates and JEO Consulting Group, Inc., 2000, p. 136). It is stated that among the aspects of land use in Elk Creek that need to be examined more closely is "the need to make use of the substantial percentage of land within the corporate limits that has remained vacant or undeveloped," (Stahr & Associates Community and County Planning Associates and JEO Consulting Group, Inc., 2000, p. 138). Some of this land can be found in the more agricultural and industrial areas of the community. The open land is located in the northeastern portion of the village and in the area south of the railroad tracks that run through the village (Stahr & Associates Community and County Planning Associates and JEO Consulting Group, Inc., 2000). Agricultural, vacant, or undeveloped land makes up the third largest land use category, behind highway, street, and alley rights-of-way, and residential uses, in the 77.49-acre community. This amounts to 16.27 acres, or 20.8% of the land within the corporate limits of Elk Creek (Stahr & Associates Community and County Planning Associates and JEO Consulting Group, Inc., 2000). The plan also mentions that land uses in the extraterritorial jurisdictional area include, "agricultural lands, farmstead development, non-farm rural residential development, public and recreational lands and limited commercial activity" (Stahr & Associates Community and County Planning Associates and JEO Consulting Group, Inc., 2000, p.138).

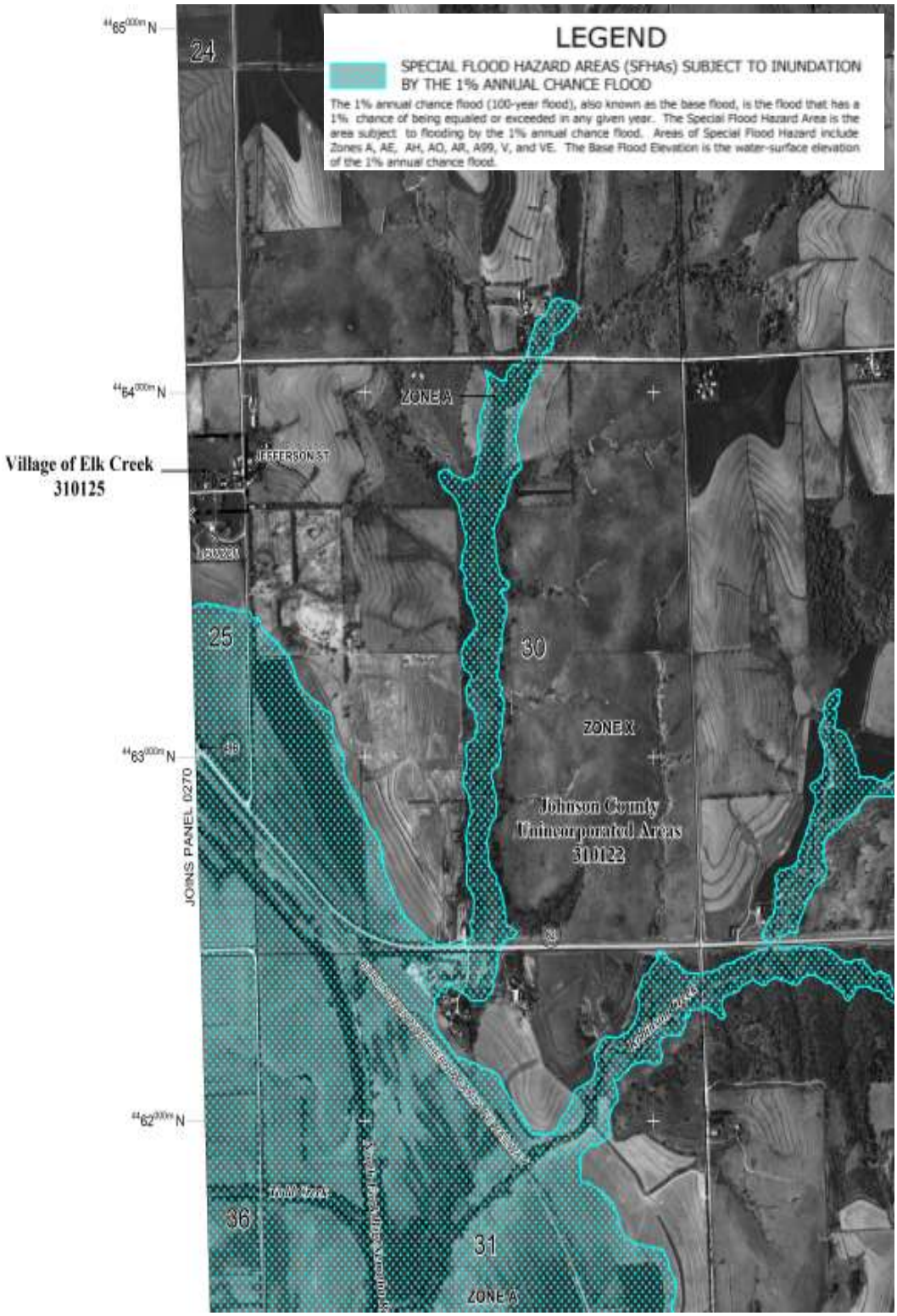
Elk Creek is split between two Flood Insurance Rate Maps (FIRM) with one showing the western portion of the community and the areas around it (Figure 10, p. 23), and the other showing the eastern portion (Figure 11, p. 24) (National Flood Insurance Program, 2006a; National Flood Insurance Program, 2006b). These maps show that much of the land outside of the outside of the 100-year floodplain, both within and

Figure 10 Flood Insurance Rate Map (FIRM): West of Elk Creek, Nebraska



Source: (National Flood Insurance Program, 2006a)

Figure 11 Flood Insurance Rate Map (FIRM): East of Elk Creek, Nebraska



Source: (National Flood Insurance Program, 2006b)

outside of the corporate limits is to the north and northeast (National Flood Insurance Program, 2006a; National Flood Insurance Program, 2006b). This, combined with the fact that the current land-use map shows that vacant land is found in the northeastern portion of the community and the future land-use map calls for low-density residential development in the northeast, further supports the fact that future housing development in the community should be completed in the northeastern portion of the village (Stahr & Associates Community and County Planning Associates and JEO Consulting Group, Inc., 2000).

Chapter 3: Past Experiences and Boomtown Housing Options

3.1 North Dakota Experiences

Boomtowns have existed for quite some time. The most recent situation in the forefront of the media has been the oil extraction communities of North Dakota. The article "Rural North Dakota's Oil Boom and Its Impact on Social Service" states that there have been "three distinct oil boom periods" (Weber, Geigle, & Barkdull, 2014, p. 64) in North Dakota. Those periods are 1951 to 1955, the 1970s and 1980s, and the most recent boom (Weber, Geigle, & Barkdull, 2014). A New York Times article mentions that the most recent boom appeared around the year 2007, at least in the area near Stanley, North Dakota (Davey, 2008). The article does not indicate when it began in other communities in the area. However, from this article, we know the boom had commenced in North Dakota at least by 2007.

One issue with boomtowns is the fact that it is difficult to know how many people might move to a community as a result of a boom. In some cases, it is also hard to keep track of actual populations due to the large number of temporary workers in the area. A population study was completed for the city of Williston by researchers at North Dakota State University. The researchers used "a model based on housing inventory" to determine the population (Hodur & Bangsund, 2015, p. 3). They were trying to find the service population which they "defined as the sum of the resident population and others who work or reside in Williston but do not meet the residency criteria as defined by the U.S. Census Bureau" (Hodur & Bangsund, 2015, p. 2). Hodur & Bangsund (2015) mention that the group that does not fit the Census Bureau criteria "includes non-resident workers that maintain residency elsewhere or others who reside in Williston or Williams

County" (Hodur & Bangsund, 2015, p. 2). Jason Foster and Alison Taylor mention in another article that this population can also be referred to as a "'shadow population,' which refers to individuals who are not officially recognized through enumeration as residents, and yet who spend time in a region" (Foster & Taylor, 2013, p. 168). The study Hodur & Bangsund (2015) study says that the population of Williston in 2015 was estimated at about 31,143 and the population of Williams County was estimated to be 52,778 (Hodur & Bangsund, 2015). This is much higher than the 2010-2014 American Community Survey Estimates of 19,849 (Census Bureau, 2010-2014b) for Williston, and 27,066 for Williams County (Census Bureau, 2010-2014a). Through this study, we can see how the Census data and estimates can underestimate the population of the people living in boom communities. It is important to include temporary populations in order to provide an adequate amount of housing and infrastructure. However, it is possible that a community might not see a large number of temporary workers. If enough locals are hired, then a large number of temporary workers may not be needed. In addition, the NioCorp mine near Elk Creek is predicted to operate for at least 32 years (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). If a mine is predicted to last for a long period of time, it is possible that the jobs might be stable enough to attract permanent workers and their families, who would be much easier to track for the purposes of calculating populations.

The main housing issue observed in the North Dakota boomtowns, especially early in the boom, was simply a lack of housing and infrastructure. Jeffrey Jacquet mentions that the housing that is available at the beginning of a boom is soon gone and more is slow to come. This is due to "high labor costs and shortages, high supply costs and shortages, as well as regulatory obstacles within governments that are leery of

permitting new developments" (Jacquet, 2009, p. 17). For example, S. M. Goldenberg et. al. (2010) indicates that young people who moved to an oil boom town in Canada had trouble finding affordable housing due to the boom. In addition, we see a situation like this in the boomtowns of North Dakota. As mentioned previously, one characteristic of boomtowns is rapid growth. Small communities do not have the infrastructure and resources to accommodate extremely rapid growth. At the beginning of the North Dakota boom, people were beginning to move to the area to take advantage of job opportunities (Davey, 2008).

According to Weber, Geigle, & Barkdull (2014), the North Dakota communities learned valuable lessons from previous booms. In the first boom period, they learned that their housing stock was not adequate for the increased numbers of people flocking to the area to take advantage of the booming economy. Therefore, during the second boom period the "locals strived to build adequate physical and social infrastructure but were then stuck with the bill for infrastructure made obsolete by the bust" (Weber, Geigle, & Barkdull, 2014 p. 64). In other words, as people moved out of the area when the jobs dried up from the boom in the 1970s and 1980s, the communities still had to pay for the infrastructure built to accommodate the boom population and the assumed increase in permanent population. As a result, the infrastructure was not built immediately when the boom began recently (Weber, Geigle, & Barkdull, 2014). This, in part, led to a housing shortage, which led to a myriad of other issues.

Another housing issue in boomtowns has appeared in North Dakota more recently. Throughout the year 2015, concern was voiced in the media about the boom coming to an end and the beginning of a bust appearing in North Dakota. This was an issue due, in large part, to the fact that the prices of oil began to decrease in early 2015

(Brooks, 2015). In early 2014, the going rate for a barrel of oil was $100. By early 2015, that had dropped to lower than $50 per barrel (Siegler, 2015). According to a *McKenzie County Farmer* article (Robinson, 2015b), drilling in McKenzie County would cease to be profitable when the price drops to $27 per barrel. This price would vary depending upon the county and community. Although the oil companies are still making money in some places, the lower prices are causing problems. Halliburton, a large drilling company, has had to lay off some employees in Williston (Jean, 2015c). In addition, the number of oil rigs being used has been dropping (Brooks, 2015). Some developers have even cancelled housing projects due to being somewhat concerned about the dropping oil prices possibly slowing the pace of the local economy (Brown, 2015).

Despite the worry of a bust by some, communities such as Watford City were finding that they are still continuing to grow. A *McKenzie County Farmer* (Robinson, 2015b) article quotes the executive director of the McKenzie County Job Development Authority, Gene Veeder and the Watford City Mayor, Brent Sanford. The mayor says that families are moving to the area. He also mentions that the prices of housing have dropped and the number of apartments being built has slowed, but construction is still continuing (Robinson, 2015b). In the article, Veeder mentions that permanent jobs in the oil industry are increasing. Therefore, there is an increase in the need for permanent housing as more people continue to move to the area (Robinson, 2015b).

3.2 White Pine, Michigan and Viburnum, Missouri Experiences

The experience in Watford City provides an example of conclusions Wilson (2004) has made through studying the effects of resource development on the socioeconomic well-being of a community. Wilson (2004) examined two communities

experiencing growth due to metal mining. White Pine, Ontonagon County, Michigan saw an increase in copper mining in the 1950s, while Viburnum, Iron County, Missouri began mining lead in the same decade (Wilson, 2004). The population of both communities increased a great deal. White Pine went from 30 people to more than 1,200 from the beginning of the mine into the 1970s. Viburnum grew from a population of 25 to 550 and eventually reached a population of more than 800 in 1980 (Wilson, 2004). Despite the population increases in both communities, most of the employees at both mines lived in the county where the mine was located or in nearby counties, rather than in the nearest community. The article focuses on employment at the mines. Wilson (2004, p. 273) states that "employment at St. Joe/Doe Run [the Missouri mine], although generally showing the effects of lead prices, did not demonstrate the dramatic peaks and valleys observed for the WPM [the Michigan mine] or even the overall mine and other employment measures on the New Lead Belt." She goes on to state that the prices of lead changed about 20% per year, on average, but the mine employment change was different at the two mines. Employment changed 23% on average at the Michigan mine, but only 9% at the Missouri mine (Wilson, 2004). These figures measure the overall average change per year, as the figures both increase and decrease depending upon the year. As Wilson (2004, p. 273) puts it, "in short, even though lead prices were more volatile than copper prices, Doe Run and the counties experienced a milder ride on the resource roller coaster." In addition, interviews conducted by Wilson (2004) seem to indicate that residents of Viburnum believe that the community was fairly stable socially and economically except during a short period beginning in 1984 in which a strike occurred and a period of layoffs beginning in the year 2000. In contrast, Wilson (2004, p. 271) says that those from White Pine "focused on the instability created by strikes, layoffs, and

buyouts, among other things." They focused more on the issues that came up at the mine and the volatility that existed in the community than those from Viburnum. The article mentions several reasons for the differences between the two mines and communities. The three main reasons listed by the article are dependence on mining, geographic concentration, and options available for responding to changes.

First, the article explains that those living in Ontonagon County were more dependent on mining for employment than those living in the area near the Missouri lead mine (Wilson, 2004). This was due to the fact that both a higher percentage of people living in Ontonagon County worked at the local mine than was the case in the area near the mine in Missouri, and that mining in general was an industry that employed a larger percentage of people in Ontonagon County than this same area in Missouri (Wilson, 2004). In addition, the proximity of larger cities, including St. Louis, lessened the dependence of Iron County on mining, while Ontonagon County is located in a remote part of Michigan.

Second, the article indicates that the communities and counties in Missouri were less affected by changes at the mine due to the fact that the employees came from a wider range of counties than did the employees of the mine in Michigan (Wilson, 2004). The article states that "Ontonagon County depended more on the taxes, income, and jobs associated with the mine than did Iron or Reynolds Counties. Ontonagon reaped a large portion of the benefits from the mines, but it also suffered more when the mine wavered" (Wilson, 2004, p. 276). Therefore, if employees get laid off at the mine in Missouri, there is less of a chance that the employees live in Viburnum or Iron County. This means that there is less of a chance a bust will occur in a particular community due to the misfortunes of the mine (Wilson, 2004). Wilson (2004) gives the example of the mine in

Missouri laying off around 80 employees in the year 2000. Wilson (2004, p. 276) states that while 5 of those 80 lived in Viburnum, "even in a place as small as Viburnum, the loss of 5 jobs will not close the grocery store." The article also states that the location of a mine, as well as the size of the ore deposit, makes a difference. This is because a mine with fewer drill sites in a remote area will cause a concentration of people in a particular community or location due to the need to live within a certain distance of the mine site. This concentration of people who work at the mine will be more affected by economic changes in the mine (Wilson, 2004). What Wilson (2004) is essentially saying is that if more people dependent on one company for employment are concentrated in one community or county, the economic risk to that community or county is greater if that employer were to fall on hard times and needs to cut some employees or close. If those people move out of the area to find new jobs, the community could lose the benefits of having those people in the community, such as spending money at local shops and paying taxes. This could then hurt the economy of the community, by hurting the local businesses.

The third reason for differences between the impacts of the two mines on the communities near them is the ability to react to the economic changes at the mine. The article gives an example, mentioning that the lead mine in Missouri had more than one mine and adjusted to economic changes by moving workers from one mine to another, while the Michigan copper mine only used one mine (Wilson, 2004). The Missouri deposit had more diverse quality of ore than the Michigan deposit and could cut back on mining the lower quality sections during hard economic times (Wilson, 2004).

The article is essentially stating that the fluctuation of prices of a commodity harvested from a mine affects communities, but not always with the same severity. The

effect may be more or less severe depending upon the concentration of workers in the same industry compared to the those in other industries, the concentration of workers in the same industry in one location, and the ability of the company to adjust to changes in commodity price (Wilson, 2004). Therefore, the likelihood of employment changes at a mine, or possibility of a bust in a community, can be examined by looking at these circumstances of the mine and examining how they might affect the nearby community. The Watford City example demonstrates this well. While other oil communities in North Dakota were struggling, the proximity of Watford City to the oil was helping it to continue to thrive even in the wake of low oil prices. This article ultimately explains that prices are not the only factor that can affect the likelihood of a bust, and that busts may be possible to avoid. This is an aspect of a community that should be examined prior to expansion in order to determine the possible need to prepare for a bust.

The chances of a bust may also be mitigated if the community cooperates with the mining company rather than relying on the company for services. Cheshire (2010, p. 16) indicates that many companies begin providing services to help the small mining communities in order to gain what she calls a "social license to operate." The community is happy that the company is providing services, and the company is happy that the community is cooperating with them and allowing them to mine in the area. However, Cheshire (2010) states that this can cause a problem if the community depends too heavily on the mining company for services in a similar way that a community can rely too heavily on a company for employment. It is possible that this could lead to socio-economic issues and a bust situation if the mining company fails or leaves. Labonne (1999) explains that the company helping to provide services is beneficial if they partner with the community to provide the services. One other way for the

communities to combat the problem of mining communities becoming dependent on the company is for the community to create projects that encourage other industries to move to the area. This would make the economy of the community less dependent on the mine and better able to withstand the economic ups and downs of the mine, and continue to be successful if the mine closes or fails (Labonne, 1999).

3.3 Temporary Housing Options

The recent boom caught North Dakota in a strange housing situation. Previous booms had taught that it was important to strike a balance between providing housing for newcomers to the community and overbuilding and risking having empty houses and infrastructure in the event of a bust situation (Weber, Geigle, and Barkdull, 2014). Despite these experiences, the North Dakota communities still ran into a situation in which there was not enough housing available to the people who moved into the communities. This led to a massive increase in housing prices. This meant that many people could not afford the little housing that was available (Burnes, 2014b). These problems have contributed to another housing related issue, providing facilities for employees living in the community on a temporary basis. Many mining employees often do not move to a mine area for several reasons. First, they work in block shifts, which allows them to take time off to go back home (Petkova et. al., 2009). They also often do not know how long a mining job will last, as commodity prices can affect the number of employees a mine can afford to keep (Sulzberger, 2011) (Wilson, 2004). As was the case in North Dakota, many workers find housing too expensive in boomtowns to move there with their families (Carrington & Pereira, 2011). In addition, living in larger cities allows

the families of the miners to live in communities that contain amenities that many smaller mining boomtowns do not have (Petkova et. al., 2009).

The main types of temporary housing solutions available are crew camps, or man camps as they are often called, RVs, and mobile homes. By the year 2011, the communities of northwestern North Dakota were experiencing many changes. Many people had moved to the area to take advantage of new job opportunities in the oil industry, followed by those looking to take advantage of increased wages in other industries as a result of competition with the oil industry (Ellis, 2011a). As more people moved into the area, fewer housing options were available. The hotels and empty apartments filled up quickly (Ellis, 2011a). Temporary housing facilities were built to house oil field workers who could not find other housing options. Many people moving to the area were forced to revert to obtaining or renting recreational vehicles (RVs). In Williston, some people parked the RVs in places such as the local Walmart parking lot (Ellis, 2011c). Yet others had to resort to living in their cars, sometimes in the same parking lots (Ellis, 2011c). One small North Dakota community, Noonan, provided space at the local campground for RVs (Mayda, 2011). An interesting idea that one company came up with was to open an indoor RV park in Watford City, North Dakota (Pioneer Press, 2012). The park provides 10 buildings with bays for 240 RVs (Pioneer Press, 2012). They have the ability to provide sewer and water solutions, as well as facilities for laundry. Like apartments, the bays for RVs must be rented on a 12-month lease (Pioneer Press, 2012). The price to stay in the indoor lots is dependent on the size of the RV for the and ranges between $695 and $995 per month. The park does offer outdoor spots, which cost $550 per month. Both spaces require an extra $100 per month for any person over 2 living in the RV (ND Indoor RV Park, 2016). The units can be converted to

storage units after they are no longer needed for RVs that provide housing (Pioneer Press, 2012). This is an example of how innovative solutions can appear that may not have been thought of previously when a community is faced with unfamiliar situations. Living in RVs and cars was not an ideal solution due to the fact they needed to be parked somewhere and those living in them did not own any land on which to park them.

More conventional solutions for the need for temporary housing units have been for mining companies or private businesses to offer spaces to mine employees in crew camps, as mentioned previously (Ellis, 2011c). Semi-permanent housing, or manufactured homes, could be a solution as well. Manufactured homes are also often referred to as mobile homes. They are a viable solution for boomtowns because they are cheaper than traditional style homes (Beamish et. al., 2001). According to an article by Richard Genz (2001, p. 396), "most buyers of manufactured homes have low incomes and little wealth." He states that the median income of those living in manufactured homes in 1997 was $23,413, while the median income in 1999 of those buying manufactured homes during the 8 years prior to 2001 was $30,000 (Genz, 2001). He also states that they tend to be half as expensive per square foot as traditional style homes (Genz, 2001). He states that, as of the time the article was written, the cost of a 1,000-square-foot house was about $26,000 (Genz, 2001). The fact that this type of housing is available for those with low incomes means that it could be a viable option to providing affordable housing in a boom community. The main issue with providing this type of housing is that it is not well perceived by those who live in traditional style housing. These units are seen by many people as being "old, having a fairly bad appearance, and housing low-income people who exhibit bad social behavior," (Beamish et. al., 2001, p. 386). This is an especially difficult perception to deal with, because while there are

methods of making these units look more aesthetically pleasing, this requires the expense of constructing the home to rise, and may make it too expensive for low-income people (Beamish et. al., 2001). In other words, trying to change the housing to make it more likely to be accepted by those in a community may actually make it less affordable. Therefore, it is important for community decision makers to understand that if they allow mobile or manufactured housing as a way to offer affordable housing during a boom, it may not be well accepted by some in the community. Therefore, it may be important to replace it with more traditional style housing once the boom is over, depending upon the size of the backlash, especially since the life expectancy of manufactured homes is around 55.8 years (Genz, 2001). One example of a mobile or manufactured home can be found in Figure 12. Another can be found in Figure 13 (p.38).

Figure 12 **Mobile home, Temple Grove Caravan Park**

Source: (McGregor, 2011)

Figure 13 **Mobile home**

Source: (Brown, 2004)

A similar form of housing is used by FEMA in emergency situations. This seems to indicate that it is a viable option for quickly erecting units to deal with a population that is in need of homes. FEMA uses manufactured homes as part of their program of providing temporary housing units (THUs) to people who have lost their homes in disaster situations. These THUs often have aluminum siding and are shaped very similar to a trailer home (Aldrich & Crook, 2013). There are three forms of THUs that FEMA has used. These include manufactured homes, as already described, park model homes, which are more compact than manufactured homes, and travel trailers. FEMA has decided that travel trailers, or RVs, will only be used as a last resort and that park models will no longer be used after an announcement made in 2012 (U.S. House of Representatives, 2009). The dimensions of the manufactured homes used by FEMA are 12-14 ft. X 40-64 ft. They can contain up to three bedrooms (U.S. Department of

Homeland Security Office of Inspector General, 2013). Aldrich and Crook (2013) explain that the two main ways a community decides where to place a FEMA trailer park site after a disaster is to focus on areas that are less vulnerable to future disasters, such as flooding, and where it can be placed quickly, as to get those who need the housing in it faster. The need for providing housing quickly makes it more likely that these parks are placed in the rural portions of a community, where space is more plentiful (Aldrich and Crook, 2013). Due to the fact that FEMA housing is very similar to manufactured housing, and the fact that many resource boomtowns are located in rural regions, it is highly possible this type of housing could work as a quick, cheap way to provide housing for families in a boom scenario. Although classified as temporary housing, the potential longevity of FEMA housing or mobile homes means that families may have a choice as to whether to use the housing permanently or temporarily. If the community officials decide to accept the housing, it could become a permanent solution. If some community members do object to this type of housing, it could instead be used as a temporary solution until traditional housing or apartments can be built. Figure 14 (p. 40) shows a photograph of a manufactured housing unit used by FEMA.

Another solution to the housing issue in North Dakota has been to implement crew camps, often called "man camps" in addition to renting apartments and hotels when available. These facilities often consist of temporary housing units and are often built by oil companies looking to house their employees. However, some private companies have built facilities as well (Ellis, 2011c). These facilities have earned the name "man camps" due to the fact that most of the workers in the oil industry are male (Meinert, 2013). They can come in many shapes, sizes, and forms, with many different amenities. Meinert (2013, p. 33) states that as of the time his article was written "there are 25 crew camps in

Figure 14 **Manufactured Housing Unit**

Source: Adapted from (U.S. Department of Homeland Security Office of Inspector General, 2013, p. 3)

the Williston area with almost 9,000 bedroom units. Many rival the size of nearby towns. In fact, many have their own water supplies, haul out their waste and have their own security forces." They are often similar to college dorms and built using modular housing. Meinert (2013) explains that they often have recreation rooms, weight rooms, and computers available for the workers. Camps listed by Meinert (2013) range in number of units from 343 to 500. One costs $95 per night to stay in. Meals are offered as part of that price (Meinert, 2013). Sulzberger (2011) states that one camp in Williston that had not been completed in 2011 would have 900 people staying in it. While some camps are built inside the city limits in places like Williston, some are also built outside the city limits in the extra-territorial planning and zoning jurisdiction (Jean, 2015b). Figure 15 (p. 41) shows an example of a man camp in Williston, North Dakota.

Figure 15 **Man Camp in Williston, ND**

Source: Adapted photo (Williston, ND, n.d.)

The unavailability of more permanent housing, such as single and multifamily housing has led to another major issue: high rental costs. The lack of housing in the North Dakota oil extraction area meant that vacant houses or apartments were in high demand. This led to an increase in prices in the housing industry. In February of 2014, it was reported that North Dakota was home to two of the top four communities in the nation with the highest average rent for a one bedroom, 700 square-foot apartment. Of these two communities, Williston and Dickinson, Williston earned the top ranking in the nation (Burnes, 2014b). This shows that while people were earning more money in North Dakota, their standard of living may have been lower due to a higher cost of living and, in some cases, a lack of shelter. To combat the lack of housing and to take advantage of the high wages, temporary housing was built. Jacquet mentions that "severe housing

shortages will invariably lead to skyrocketing housing prices," which, "can provide a hardship for existing residents who are either not homeowners or plan to remain owner-occupiers of their property," (Jacquet, 2009, p. 18).

An article written for *The New York Times* (Sulzberger, 2011) contains a quote from a Williams County, North Dakota planning official. This official (Jill Edson) indicates that housing structures for oil workers are often temporary because many of the workers will eventually leave when the temporary jobs are gone and there is no reason for them to be there (Sulzberger, 2011). In addition, a *CNN Money* article (Ellis, 2011b) mentions that the workers often did not bring their families, in part, because they did not know how long the boom would last, and how long they would be there. In other words, the workers are there on a temporary basis until the jobs run dry, and they will then leave to find new jobs. Therefore, they left their families in the location they previously lived in and visited them when they were on break from their jobs.

Many boom communities are opposed to accommodating a large amount of temporary housing. Jacquet mentions that temporary housing, especially mobile homes "can be controversial, as many people find that mobile homes degrade the quality of life," (Jacquet, 2009, pp. 17-18). An article published on the *The New York Times* website (Sulzberger, 2011) states that the executive director of Williston economic development at the time, Tom Rolfstad, thought bringing in more permanent housing would help to attract families to the area. It could also help bring down housing prices. Some communities began taking action to try to limit the amount of temporary housing being built and encourage the construction of permanent structures. The goal of this would be to encourage permanent workers to move to the area. This information indicates that there may be some resistance to some forms of temporary housing, such as mobile

homes, in communities As a result, some communities may try to limit the inclusion of these housing types. However, the zoning code for Johnson County, Nebraska does allow mobile homes to be built with a special use permit in agricultural residential districts (Zoning Resolution of Johnson County in the State of Nebraska, n.d.).

In 2014, a *Williston Herald* (Burnes, 2014a) article mentioned that a plan to renew already built crew camps on a two year basis was passed by the county commissioners of Williams County. In other words, the camps being used could be renewed after a two year period, but only for one more two year period. The article also mentions that the eventual aim of the commissioners was for only permanent housing and not crew camps or other forms of temporary housing to be built (Burnes, 2014a). Some people criticized the decision, citing that the temporary workers in the oil industry would not buy a permanent residence and would therefore have no place to live if the crew camps were removed (Burnes, 2014a). This shows a resistance from the community decision makers for crew camps, but an understanding from some that they are necessary. The community recognized the need to house temporary workers in crew camps, but did not want any more future camps being built. Communities are essentially offering housing that can leave when the workers do, and not making them look for housing among the permanent housing units, which are scarce and could be used by those who might be willing to stay when the temporary workers leave (Burnes, 2014a). The issue of temporary housing, such as crew camps, is a battle between the necessity for it, for both financial and practical reasons, and reluctance of community decision makers to accept them. However, the fact that decision makers in North Dakota communities have tried to limit the inclusion of crew camps may indicate that other communities, such as Elk Creek or other villages and cities in the area may see a similar issue. Communities must

learn that in the event that housing temporary workers is necessary and the rental housing stock is not sufficient, they must be used. Trying to push these types of units out of the community too early could raise housing prices and cause a major housing shortage (Burnes, 2014a). This could result in workers choosing to live in other nearby communities rather than Elk Creek. The Johnson County Comprehensive Plan and zoning code do not reference crew camps (Stahr & Associates Community and County Planning Associates and JEO Consulting Group, Inc., 2000) (Zoning Resolution of Johnson County in the State of Nebraska, n.d.).

In July of 2015, it was announced that the Williams County director of Development Services had proposed a plan for temporary housing application guidelines and they had been adopted by the County Commission (Killelea, 2015). This plan would not allow temporary housing applications to be renewed or new facilities be built unless they met some exemption rules (Killelea, 2015). The exemptions include being "opened seasonally from March 1 to Dec. 1, with a minimum of five beds; operating seasonally for the state of North Dakota; operating year round that have 50 or more beds" (Killelea, 2015, paragraph 4). The aim of this is to eventually force the temporary housing out, but doing so slowly, as removing it all at once would cause housing prices to rise and lead to further housing shortages (Killelea, 2015). Again, this shows that community officials do not want to accept temporary housing, but know they must until it is clear that enough housing is available to everyone, and that temporary workers are no longer needed.

In addition, a September 2015 article states that Williams County adopted new subdivision regulations (Jean, 2015a). One of the new regulations includes a restructuring of zoning districts. The new set of zoning districts includes one named a planned unit development, allowing for flexibility in building mixed-use developments

(Jean, 2015a). In addition, restrictions on RVs and mobile homes are included. It is apparent that these new regulations are attempts by communities to obtain more control over temporary housing. Again, this seems to indicate that temporary housing is generally unwanted, but can be necessary if large numbers of temporary workers choose to live in an area. Temporary housing may not be an issue if there are not many temporary workers. One of the biggest problems for a potential boomtown is determining whether or not there will be a major influx of temporary workers. NioCorp officials have indicated that they would like to hire and train local people as much as possible (J. Sims, personal communication, February 16, 2016). This coupled with the fact that the mining jobs have the potential to be long term, even lifetime, jobs, may reduce the number of temporary workers moving to Elk Creek.

3.4 Permanent Housing Options

The main issue regarding permanent housing in a boomtown is to make sure that the community provides affordable housing options to try to attract mine workers, as well as others, to the community. At the same time, they must try not to build so much housing that there is an excess in the case that the industry or business causing the boom fails or leaves the community. This becomes a big challenge because many boom communities are small and may not have a great deal of excess housing. This means that much of the new permanent housing must be built. This is also why much of the focus in North Dakota was on temporary housing until recently.

Communities have used different tactics to try to offer affordable housing to both newcomers and current residents. Fort McMurray, a larger community in Canada that has experienced a recent boom due to an increase in oil production in the area, has built

micro-apartments and townhouses to provide affordable housing (Keough, 2015). The planners in the community say that these types of affordable housing units were built because they are cheaper to rent and own than traditional housing, due to the fact that they are cheaper to construct (Keough, 2015). The construction costs are lower due to the lower costs of the materials used to make the structures. In addition, it is not necessary to build them on as large a piece of land because they are connected to each other (Keough, 2015). These styles of structures may not be necessary in a community as small as Elk Creek. However, it is important to think about using cheaper construction materials and using smaller lots in order to lower the price of housing. This type of housing does line up with the comprehensive plan for Elk Creek, as current residential areas in the community are listed as high density residential on the Future Landuse Plan Map (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015).

Other housing solutions come from mines found in Chile. The Escondida and Zaldivar mines came up with alternatives to building towns for workers. The Escondida mine built housing in one location, as it would if it built a town, but instead built a new neighborhood in an existing community (Newbold, 2003). Newbold (2003) states that this strategy was not completely successful because the miners still lived in their own separate communities. Zaldivar decided to offer loans to its employees to pay for housing. They let the workers live wherever they wanted to and in whatever style of housing they wanted (Newbold, 2003). The company forgave the loan if the employee stayed with the company for 6 years. Newbold (2003) says that this allowed the employees to feel like members of the community and decide for themselves where they wanted to live. This type of housing allows the employees the freedom not to worry as much about the financial aspect of finding housing. This negates the need to find cheaper

housing in another community and allows the worker to live in the community affected by the mine and become part of that community without having to commute from somewhere else. However, this option depends upon sufficient housing stock being available in a community and would not work in a village as small as Elk Creek.

Permanent apartment buildings can be a good way to offer housing to both temporary workers and permanent residents. One way to offer apartments is to convert currently unused buildings in the community. This has been done in more than one community in North Dakota. In Noonan, North Dakota, a nursing home was converted into an extended stay hotel called the Crash Pad (Mayda, 2011). In Williston, North Dakota, Lutheran Social Services of North Dakota converted an old school building into senior housing. The school used to be the Junior High School building for Williston, and the High School building before that (Lutheran Social Services of North Dakota, 2016). Figure 16 depicts a photograph of the building. The building contains 44 apartment

Figure 16 **Renovated Williston Junior High School**

Source: Adapted photo ([untitled photograph of renovated Williston Junior High School], n.d.)

units, as well as common areas (Lutheran Social Services of North Dakota, 2016). A 2012 press release from the Industrial Commission of North Dakota states that the cost of the project was $10.6 million and was partially funded by the three main levels of government – federal, state, and local (Industrial Commission of North Dakota, 2012). Many communities within a 50-mile radius of the future Elk Creek mine site contain empty school buildings that might be able to be converted into housing units for future temporary or permanent residents. One such school building is available in Elk Creek. A picture of the school building at Elk Creek is found in Figure 17 (p. 49). Feasibility studies would need to be completed to see if this was a viable option. However, this could be an answer that would prevent the need to build new housing. In addition, the school buildings could possibly be converted again or used for other purposes of they are no longer needed for housing.

Finally, a study was conducted by researchers at North Dakota State University titled "The New Normal: The Direct and Indirect Impacts of Oil Drilling and Production on the Emergency Management Function in North Dakota" (Cwiak et. al., 2015). The paper offered report recommendations based upon some of the direct and indirect impacts of drilling on emergency management in the state of North Dakota. An invitation-only survey was distributed to 113 people with 44 responses from emergency management and partner agency participants, such as health, fire, and law enforcement agencies (Cwiak et. al., 2015). The article states that "report recommendations were framed around the impact themes culled from study participants' comments, and informed by the research teams' subject matter expertise and materials reviewed as a part of the study effort" (Cwiak et. al., 2015, p. 71). Recommendation 17 for direct impacts reads as follows: "Address essential personnel housing needs with employer-offered benefits; community-

Figure 17 **Vacant Elk Creek School Building**

Source: (Bogle, 2016c)

owned, rent-controlled properties; or, a state tax deduction," (Cwiak et. al., 2015, p. 94). The researchers propose several different solutions as part this recommendation. The first is that essential personnel, such as those working for the city or county, teachers, emergency responders, doctors, and others that provide essential services to the community, would receive subsidized housing. If that is not possible, they believe they should receive affordable housing. Next, they mention companies offering housing benefits to their employees. The researchers say that this may cause some issues if some employees actually have reasonable housing prices or if they have roommates and do not pay as much for housing, as they would then be paying lower prices than those who live alone or pay higher prices without assistance (Cwiak et. al., 2015). A third option, community-owned, rent-controlled units, would cost a great deal of money to build and run. However, the community would be in complete control of who lived there (Cwiak et. al., 2015). The researchers also recommend that individual contracts could be created

to subsidize rent for buildings owned by private companies or individuals. Finally, the researchers mention that it is possible to offer tax deductions for those essential personnel needing housing. This could work by allowing an individual to deduct a percentage of the difference between the actual cost of the individual's housing and a state-defined reasonable housing cost baseline from the amount he or she is required to pay for state taxes. However, this does not add to the housing stock, but instead just helps people pay for housing, but does not guarantee that available housing exists (Cwiak et. al., 2015). While all of these recommendations could work to offer affordable housing, some would require local governments to spend large amounts of money and may not be a viable option for a smaller community like Elk Creek. NioCorp offering housing benefits might work in Elk Creek, as long as the housing stock is increased to offer housing for the employees.

On the subject of subsidized or affordable housing, The Nebraska Department of Economic Development offers Affordable Housing Program grants to help communities and other organizations provide affordable housing (Nebraska Department of Economic Development, 2016). The Nebraska Affordable Housing Trust Fund was created in 1996. The program offers funds to various organizations, including local governments, for providing affordable housing to low income families. The activities eligible are stated on the Nebraska Department of Economic Development (2016) website in bulleted format as follows: "Rehabilitation of existing housing, homeownership opportunity program using existing housing, housing development, including related infrastructure assistance, new construction of single or multi-family units, or conversion of a building into housing, technical assistance, design and financial services and consultation for eligible nonprofit community or neighborhood based organizations involved in the creation of affordable

housing, and operating cost assistance (50% of total operating cost, not to exceed $25,000." A program like this could help a small community like Elk Creek with the funds to convert the local school to housing or to subsidize apartments.

One possible source of federal funding is the U.S. Department of Housing and Urban Development HOME Investment Partnerships Program. The program offers funding for communities to offer "tenant-based rental assistance; housing rehabilitation; assistance to homebuyers; and new construction of housing," along with "site acquisition, site improvements, demolition, relocation, and other necessary and reasonable activities related to the development of non-luxury housing," (U.S. Department of Housing and Urban Development, 2016b). The program offers money to communities eligible for at least $500,000 based upon a formula, as well as the greater between $3 million or an amount based upon a formula to states (U.S. Department of Housing and Urban Development, 2016a). However, in Elk Creek's case, they may not be eligible for the program, as it must be used to serve low-income and very low-income families (U.S. Department of Housing and Urban Development, 2016b). The point of pursuing funds for Elk Creek is to try to keep housing prices down by offering choices, not to provide housing to low-income families. Many of the miners would likely be making too much money to be considered low-income. However, the HUD program is one the community should look into.

To summarize, the main options for temporary housing in North Dakota were RVs, mobile homes, and crew camps. RVs are beneficial because they are cheap and do not take up much space. However, those staying in RVs often do not own land and must either rent places to park them or place them in local parking lots. Mobile homes are an option for cheap housing that can be installed in a community quickly. They can help

offset the rising prices of houses that boomtowns often see. Another option is crew camps. These are often dorm-like modular structures that are built by the mining or oil company or private companies. They are beneficial for temporary workers and can be removed after the boom is over. Permanent housing options other than traditional detached housing include offering apartments in converted buildings, or building new apartments or townhomes. Apartments and townhomes save space in a community, allowing them to be cheaper options than traditional housing. Offering converted apartment buildings allows a community to use currently unused buildings while not needing to build new structures. Other options include various forms of subsidized housing through company or community owned or subsidized buildings.

Chapter 4: Prices, Labor, Earnings, and Housing

4.1 Commuting

This chapter outlines the results of the analyses, of commodity prices, labor, earnings of mine workers, and housing, completed for this paper. Table 2 shows the number of people who commute to Johnson County for work. This was examined to

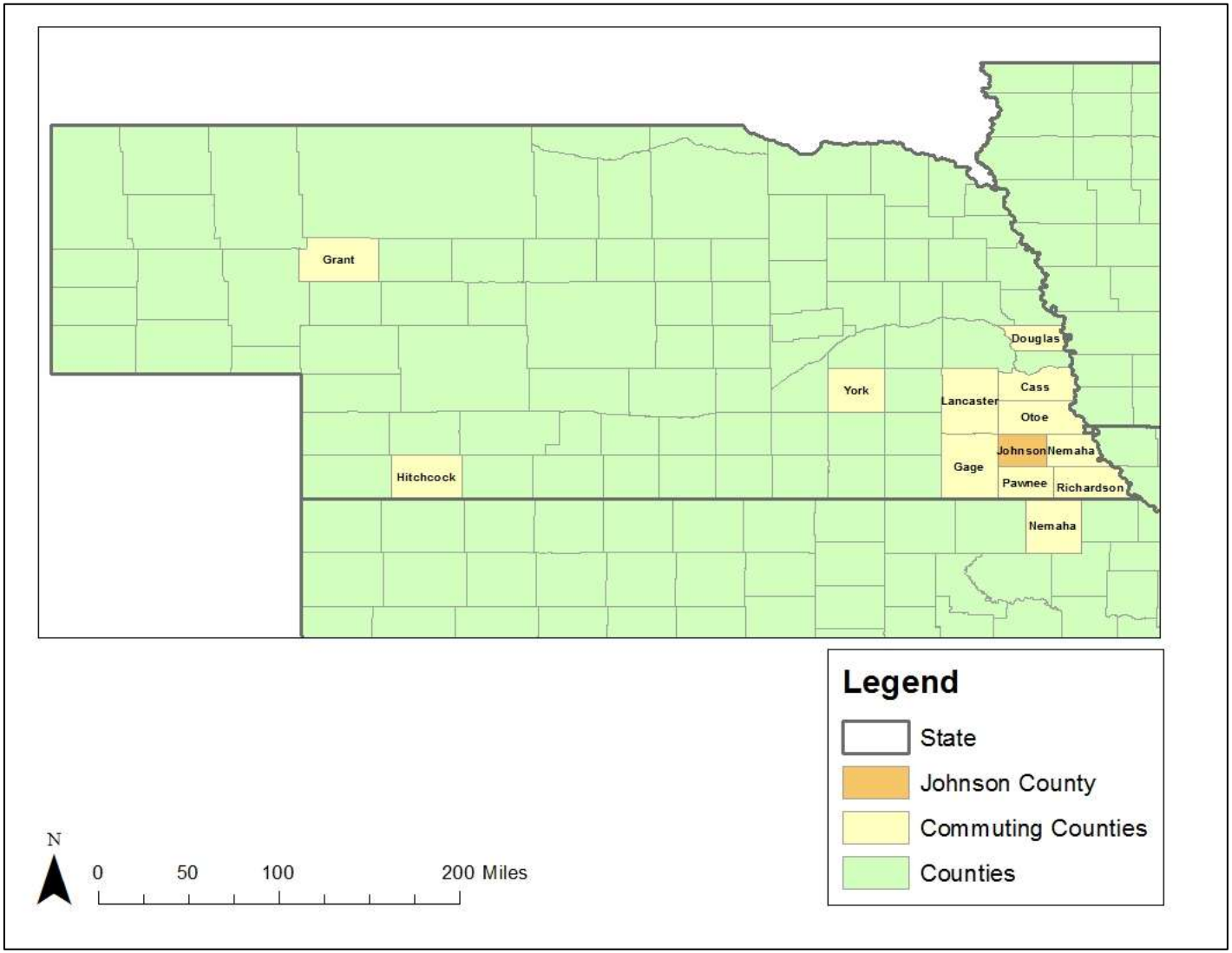
Table 2 Residents Commuting to Johnson County for Work (by County)

Residence		**Place of Work**		**Commuting Flow**	
State Name	**County Name**	**State Name**	**County Name**	**Workers in Commuting Flow**	**Margin of Error**
Kansas	Nemaha County	Nebraska	Johnson County	17	19
Nebraska	Cass County	Nebraska	Johnson County	22	15
Nebraska	Douglas County	Nebraska	Johnson County	57	83
Nebraska	Gage County	Nebraska	Johnson County	67	26
Nebraska	Grant County	Nebraska	Johnson County	11	23
Nebraska	Hitchcock County	Nebraska	Johnson County	3	4
Nebraska	Johnson County	Nebraska	Johnson County	1,144	134
Nebraska	Lancaster County	Nebraska	Johnson County	58	41
Nebraska	Nemaha County	Nebraska	Johnson County	110	48
Nebraska	Otoe County	Nebraska	Johnson County	90	37
Nebraska	Pawnee County	Nebraska	Johnson County	86	27
Nebraska	Richardson County	Nebraska	Johnson County	79	65
Nebraska	York County	Nebraska	Johnson County	4	6
Total				**1,748**	**192**

Source: (U.S. Census Bureau, 2009-2013)

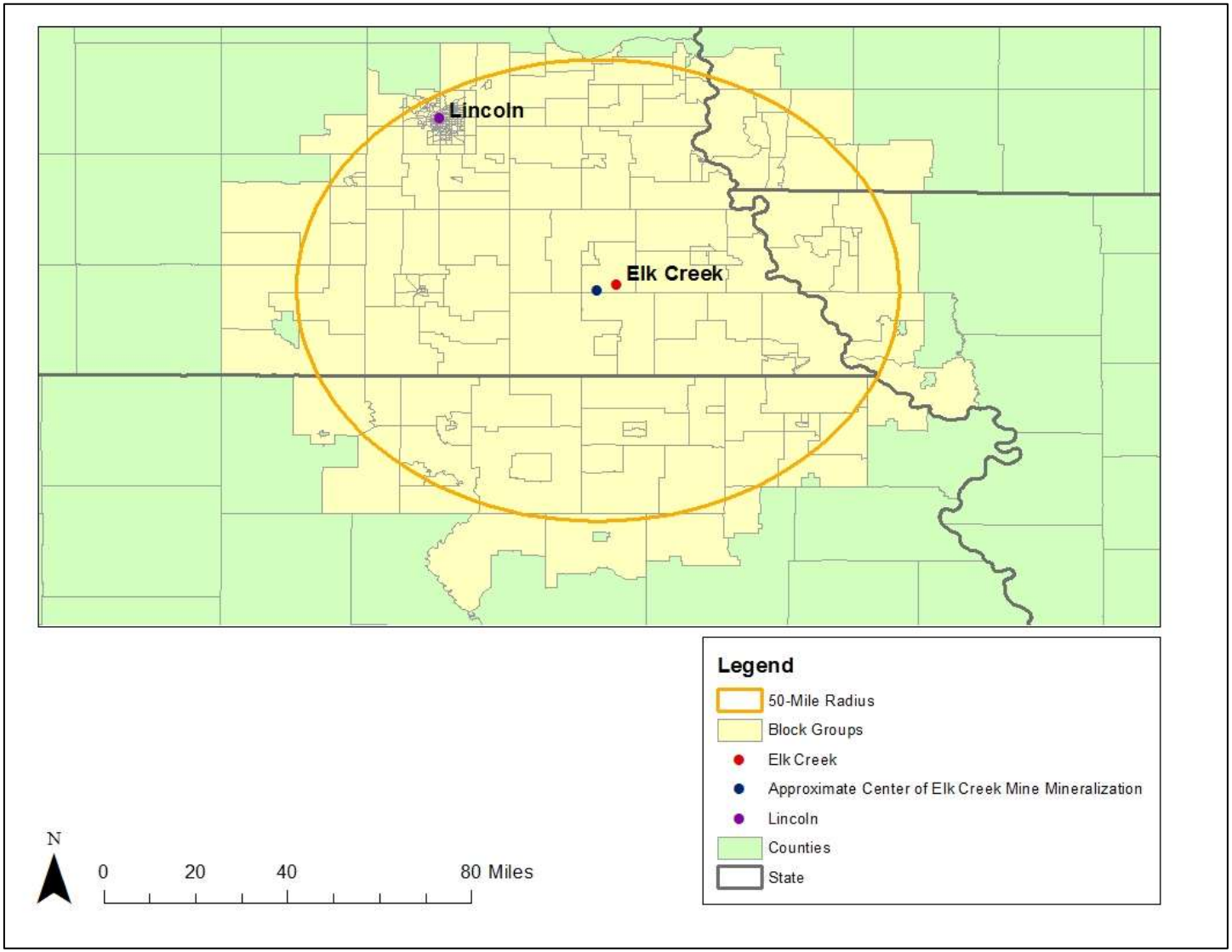
gain an idea of the willingness of those living near Johnson County to commute into the county to work. This will tell us whether it is viable to assume that some people would be willing to commute to the mining site rather than live in Elk Creek. Table 2 (p. 53) is the Residence County to Workplace County Commuting Flows for the United States and Puerto Rico Sorted by Residence Geography: 5-Year ACS, 2009-2013 table from the U.S. Census Bureau (U.S. Census Bureau, 2009-2013). The table has been modified to show only the counties which contain residents who work in Johnson County. The locations of these counties are shown in Figure 18 (p. 55). The table shows that while the majority of the estimated people who work in Johnson County also live there, it is estimated that 604 people commute to the county for work. This is about 35% of the total number of workers listed in the table and even includes an estimated 17 workers from Nemaha County, Kansas (U.S. Census Bureau, 2009-2013). While it should be noted that some of the estimates are not particularly accurate as indicated by the margin of error, the table does indicate a willingness of some people to commute to Johnson County for work. This indicates that there may be a willingness of some people to live outside of the county and still commute to the mine. It will depend on the preference of the worker. In addition, many of the counties listed in the table lie within a 50-mile radius of the future mine site. A 50-mile radius was determined to be a reasonable driving distance to the mining site, based upon the coordinates (40°16’3.5” N and 96°11’8.5” W) given for the center of the mineralization to be mined (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). In ArcGIS, a 50 mile radius buffer around the coordinate site was created for block group data and census tract data. Figure 19 (p. 56) shows the block groups used as part of the 50 mile radius. Figure 20 (p. 57) shows the census tracts used

Figure 18 **Counties with Residents that Commute to Johnson County, Nebraska for Work**



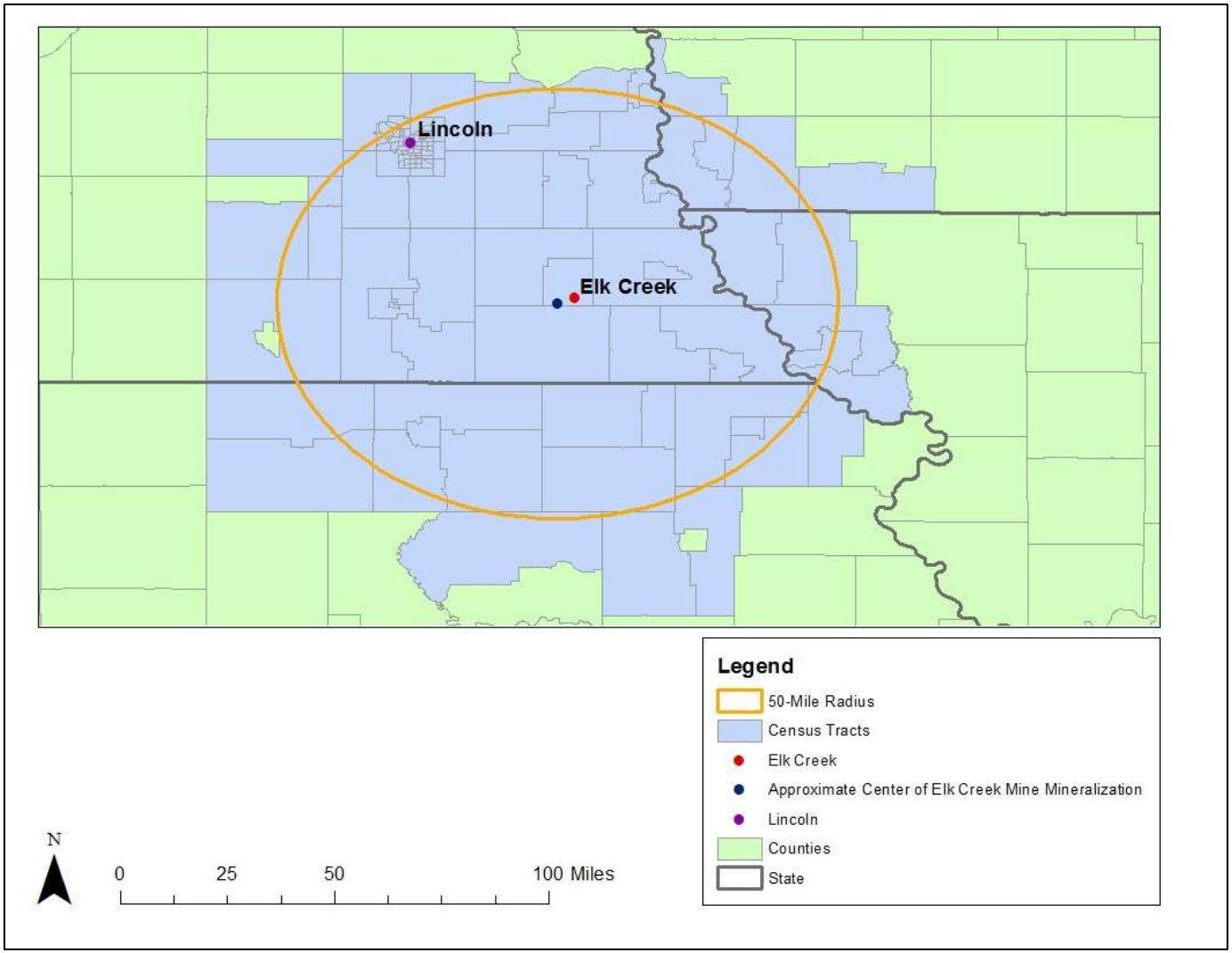
Source: **(2014 TIGER/Line Shapefiles (machine-readable data files) / prepared by the U.S. Census Bureau, 2014; 2015 TIGER/Line Shapefiles (machine-readable data files) / prepared by the U.S. Census Bureau, 2015)**

Figure 19 **Block Groups in the 50-Mile Radius**



Source: **(2014 TIGER/Line Shapefiles (machine-readable data files) / prepared by the U.S. Census Bureau, 2014; 2015 TIGER/Line Shapefiles (machine-readable data files) / prepared by the U.S. Census Bureau, 2015)**

Figure 20 **Census Tracts in the 50-Mile Radius**



Source: **(2014 TIGER/Line Shapefiles (machine-readable data files) / prepared by the U.S. Census Bureau, 2014; 2015 TIGER/Line Shapefiles (machine-readable data files) / prepared by the U.S. Census Bureau, 2015)**

as part of the 50-mile radius. The 50-mile radius represents a realistic area for the location of housing for the workers at the mine site. While Elk Creek is the focus of this paper, it is important to understand that it is likely that a larger region will be affected by the addition of mining jobs. As the community of Elk Creek is so small and does not offer a lot of current housing options, it is important for them and other nearby communities to think about a regional effort to provide housing for the area. Therefore, it is important to examine the current capacity for this 50-mile radius area as well. This was done for the economic base analysis of the 50-mile radius, the analysis of earnings in the past 12 months, and the labor force table. The exception to this rule was housing data, which used data from the 2010-2014 American Community Survey estimates within the 2014 census tracts, as the block group data was not available for this particular data. For most data using information for the 50 mile radius, the data from the 2010-2014 American Community Survey estimates within the 2014 census block groups inside or intersecting this buffer was selected out and combined to form totals for the 50 mile radius.

4.2 Commodity Prices

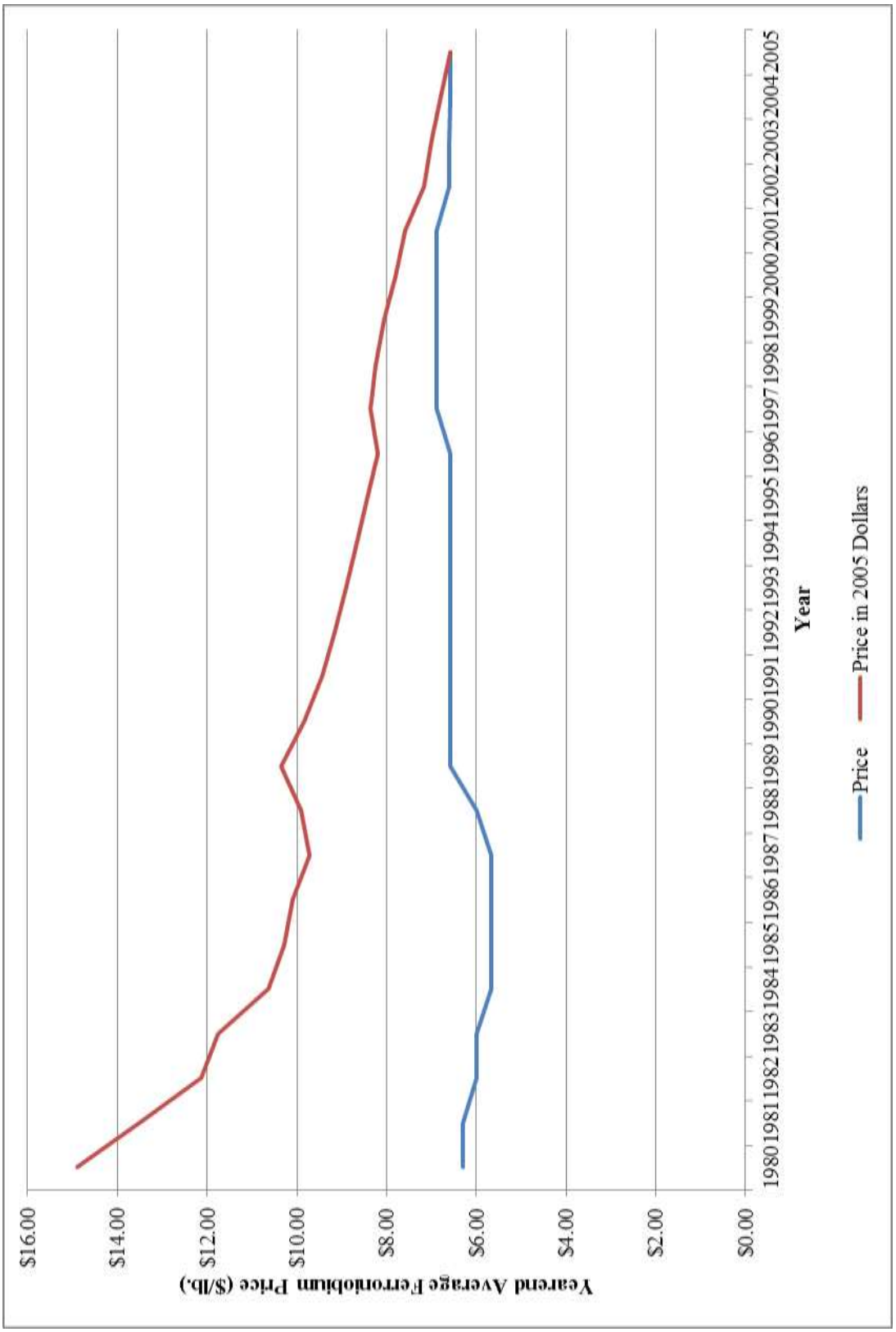
One issue in boomtowns is examining whether a bust will eventually occur after a boom. One indication of the potential for a bust occurring is to examine the stability of the prices of the commodities being mined by NioCorp. Wilson's (2004) study indicated that while the socioeconomic aspects of communities can be affected by prices of the commodities mined near the communities, they can also be based on several other factors. However, they still do have an effect of the number of employees a mine can sustain. For example, if commodity prices are stable and increasing, it is likely that jobs

at a mine producing those commodities will be stable. It the prices are unstable or tend to decrease, the number of jobs will likely decrease. This can affect the turnover of a community and lead to people moving to the area on a temporary basis rather than permanently.

The main commodity sold by NioCorp will be ferroniobium. Figure 21 (p. 60) shows the year-end average ferroniobium price per year from 1980 to 2005. This data comes from the U.S. Geological Survey. They published a report in 2013 titled "Metal prices in the United States through 2010: U.S. Geological Survey Scientific Investigations Report 2012-5188." The U.S. Geological Survey also provides price tables for many different mineral commodities. The price tables are found on the same page of the USGS website as the report and were used to create the three line graphs. The data in Figure 21 (p. 60) shows ferroniobium prices only to the year 2005 because published prices for ferroniobium were discontinued after the year 2005. It should be noted that public data on commodity prices was not available for ferroniobium, scandium, or titanium sponge. As the USGS data is limited to 2005 for ferroniobium and 2010 for the other two commodities, it should be noted that the data used in this paper is limited. However, the graphs do show some more recent historical trends in prices. Figure 21 (p. 60) contains two lines. One line shows the average price of ferroniobium per year and the other shows the same statistics in 2005 dollars. The graph shows that while the price in 2005 dollars is trending down due to inflation, prices for ferroniobium seem to have stayed fairly stable from year to year (USGS, 2015b). This indicates that the employment at the mine should not change a great deal as a result of price changes. Papp (2013, p. 115) indicates in an article for the report titled "Metal prices in the United States through 2010: U.S. Geological Survey Scientific Investigations Report 2012-

Figure 21

Average Price of Ferroniobium Per Year

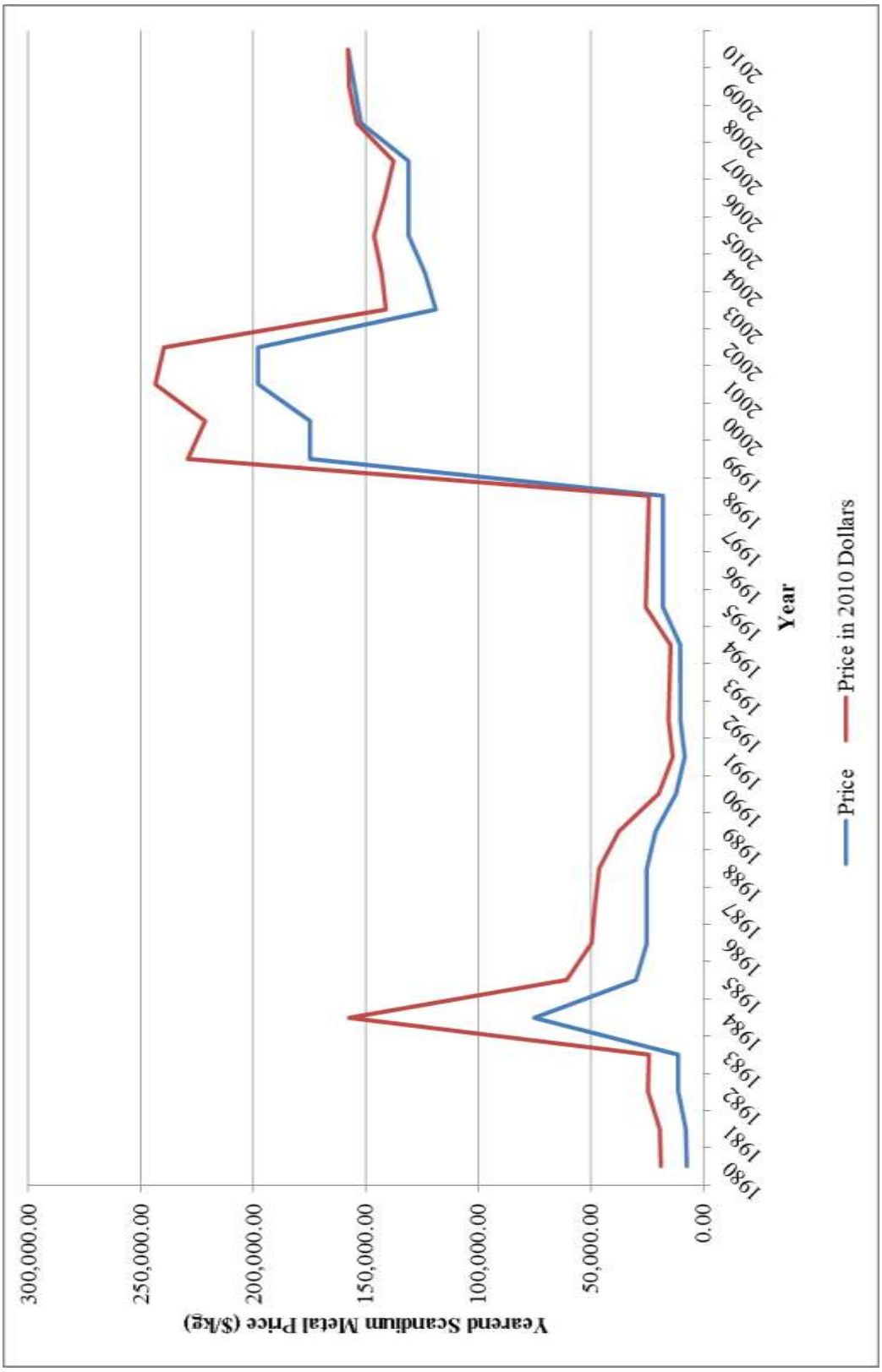


Source: (USGS, 2015b)

5188," that "as the dominant niobium producer/supplier, Brazil has maintained a marketing strategy of stable supply and moderate price changes." They can do this because, as Papp (2013, p. 115) explains, "Brazil's production of niobium concentrates, mostly pyrochlore, accounts for more than 90 percent of 2010 world production of niobium," and most of the niobium products created in Brazil are exported to other countries. Papp (2013) explains that demand for niobium increased throughout the 1990s the demand and supply increased, which caused the price to stay stable. Papp (2013) also states that demand has increased due to the increased need for niobium in China, but demand lowered in 2008 due to the financial crises throughout the rest of the world. In a separate article, Papp (2015) states that there developing countries could see increased use of niobium in the future. Papp (2015, p. 52.6) also states that "consumption of niobium is expected to increase by around 5% in 2014, in line with the expected increase in production of crude steel and niobium-bearing alloys." More production and consumption mean that more demand is probably associated. Although this is an older projection, this information seems to indicate that there is a thought that the need for niobium, may increase in the future.

Figure 22 (p. 62) shows the price of scandium per year in dollars per kilogram. There was a major rise in the price of scandium in 1984, and a fall in the price again in 1985. Between 1998 and 1999, the price of scandium per kilogram rose almost $160,000. It then lowered almost $80,000 between 2002 and 2003 (USGS, 2015c). NioCorp plans to produce 97 metric tons per year (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). The amount of scandium produced worldwide per year is 10 to 15 tons (Gambogi, 2013). However, NioCorp believes that demand will increase as the supply increases (J. Sims, personal communication, February 16, 2016). The large

Figure 22 **Price of Scandium Per Year**

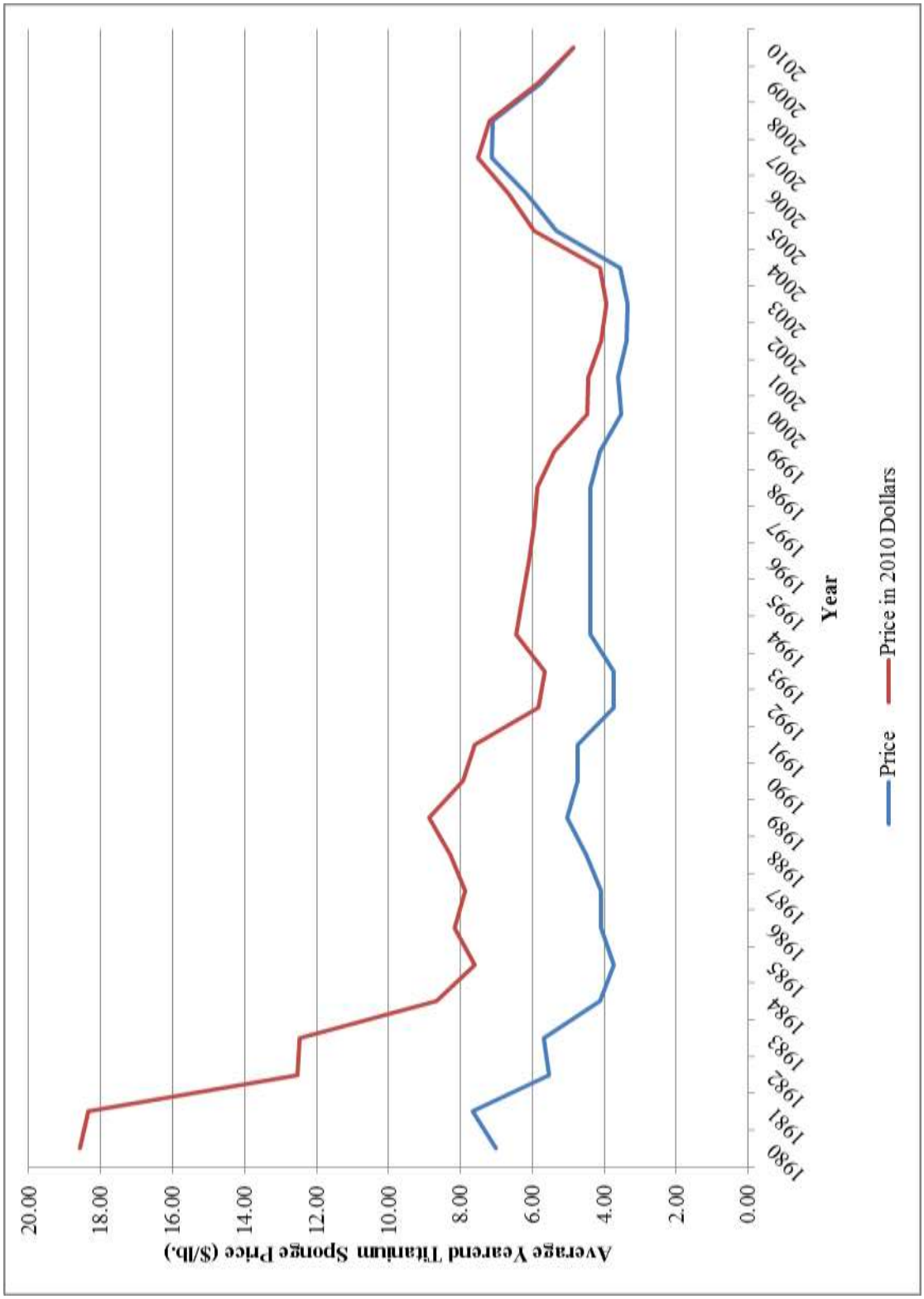


Source: (USGS, 2015c)

fluctuations in the price of scandium are different from those of Niobium. However, there is some evidence that the price can stabilize. The Preliminary Economic Assessment (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015) indicates that a market study was completed on scandium and written by Dr. Andrew Matheson. The study was created by OnG Commodities LLC and was called "Scandium: A Market Assessment." The study, according to the Preliminary Economic Assessment (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015), used two models. The first explains that the price of scandium oxide is around $3,500 per kg and will be about $3,000 per kg after the mine begins harvesting materials. This price is projected to stay at this level for a few years and then increase to about $4,000 per kg until the mine is projected to close in 30 years or so (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). This is due to the fact that the demand for scandium is expected to increase because it is valuable for aerospace applications and for fuel cells. The second model states that with the starting price of $3,500 per kg for scandium oxide, it would fall to $2,000 per kg and then rise back up until the mine closed to the original price (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). Essentially there will be an "initial drop in price as supply increases and the market becomes established, with a price recovery based on increased demand as industry consumption accelerates before it stabilizes," (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015, p. 245). This means that there is demand for scandium and the price likely will stabilize in the future, thereby lowering the risk of the mine failing.

Figure 23 (p. 64) provides a picture of the average prices of titanium sponge per year. The prices in the 30 years between 1980 and 2010 have fluctuated more than those

Figure 23 **Average Price of Titanium Sponge Per Year**



Source: (USGS, 2015a)

of niobium, but much less than those of scandium. When looking at the unadjusted prices, the average price of titanium has risen and fallen between a range of about $2/lb. in the 30 years between 1980 and 2010, with the exceptions being a fall larger fall in price in the early to mid-1980s and a rise in price and then fall in the mid to late 2000s (USGS, 2015a). The price seems fairly stable, but less stable than niobium. However, titanium is not a primary resource of the mine, but rather a by-product (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). The prices do go steadily down when adjusting for inflation using 2010 dollars. However, this is because of the use of 2010 dollars, and the prices represented by the two lines on the graph end up being closer as we move closer to the year 2010. Therefore, the price of titanium may not affect employment at the mine as much as the fluctuation in price of niobium or scandium.

4.3 Economic Base Analysis

The number of workers in each industry in Elk Creek was examined in order to determine the current and potential dependence of the community on mining. Table 3 (pp. 66-67) depicts the employment data for different industries in Elk Creek. The statistics come from the 2010-2014 American Community Survey from the United States Census Bureau (2010-2014f, 2010-2014h). It should be noted that the margins of error for the number of people in each industry group is very high and therefore not very accurate. However, these data were included in this analysis to show that there are not very many people working in any one industry in Elk Creek. Knowing this, we can see that any large increase in an industry, such as a 300 or 400 job increase in mining, would make the community highly dependent upon that industry. This would mean that the community's economy would not be very diverse and that if the industry faltered, the

Table 3 Employment Estimates for Elk Creek, Nebraska

Industry Groups (Categories within industry groups indented)	Elk Creek, Nebraska		
	Estimate	Margin of Error	Percentage of Total Elk Creek Estimate
Civilian employed population 16 years and over	70	+/-34	100.00%
Agriculture, forestry, fishing and hunting, and mining:	7	+/-9	10.00%
Agriculture, forestry, fishing and hunting	7	+/-9	10.00%
Mining, quarrying, and oil and gas extraction	0	+/-9	0.00%
Construction	11	+/-14	15.71%
Manufacturing	5	+/-6	7.14%
Wholesale trade	2	+/-3	2.86%
Retail trade	5	+/-7	7.14%
Transportation and warehousing, and utilities:	1	+/-5	1.43%
Transportation And warehousing	1	+/-5	1.43%
Utilities	0	+/-9	0.00%
Information	0	+/-9	0.00%
Finance and insurance, and real estate and rental and leasing:	11	+/-14	15.71%
Finance and insurance	3	+/-4	4.29%
Real estate and rental and leasing	8	+/-13	11.43%

Professional, scientific, and management, and administrative and waste management services:	6	+/-9	8.57%
Professional, scientific, and technical services	6	+/-9	8.57%
Management of companies and enterprises	0	+/-9	0.00%
Administrative and support and waste management services	0	+/-9	0.00%
Educational services, and health care and social assistance:	11	+/-13	15.71%
Educational services	1	+/-2	1.43%
Health care and social assistance	10	+/-12	14.29%
Arts, entertainment, and recreation, and accommodation and food services:	3	+/-4	4.29%
Arts, entertainment, and recreation	0	+/-9	0.00%
Accommodation and food services	3	+/-4	4.29%
Other services, except public administration	4	+/-5	5.71%
Public administration	4	+/-5	5.71%

Source: (U.S. Census Bureau, 2010-2014f, 2010-2014h)

community would as well. Many people would likely move out to take advantage of job opportunities elsewhere. The mining industry in Elk Creek is currently nonexistent. However, a large increase of 300 to 400 employees could create a community largely dependent upon mining for employment. This means that if something happens to the industry, it could cause a bust in the community.

Table 4 (p. 69) depicts the effects of adding both 300 and 400 mining jobs to the Elk Creek market. The percentage of total employment represented by the mining, quarrying, and oil and gas extraction category increases greatly, moving from an estimated percentage of 0% to 81% and 85% by adding 300 and 400 mining jobs, respectively. This indicates that while no mining jobs currently exist in Elk Creek, adding 300 or 400 jobs in this category to the village would make it very dependent on the mine for employment. If the mine were to close after adding jobs to the economy, it might greatly affect the economic success of Elk Creek. In addition to the mining jobs, the multiplier effect would further increase the number of jobs and people moving into Elk Creek. The multiplier effect is not calculated, as it would be extremely inaccurate due to the large margins of error. Some of the miners would likely bring family members with the intention of settling permanently in Elk Creek, as the risk of losing a job at the future mine seems low. This would increase the population of Elk Creek, but it is difficult to estimate the extent of the increase because it is unknown how many of the future employees would have families and how large those families would be. Many of the oil workers during the recent North Dakota boom did not bring their families due to the temporary nature of the jobs they had (Ellis, 2011b). The same holds true for some communities in Australia (Carrington & Pereira, 2011). However, the prospects for long term jobs at the Elk Creek mine seem to be higher, as the prices for ferroniobium are not

very volatile (USGS, 2010b). Therefore, it may be safe to assume that more people will be willing to bring their families to the area when they choose to work for NioCorp.

Table 4 Effect of Adding 300 to 400 Mining Workers in the Community of Elk Creek, Nebraska

	Mining Jobs as a Percent of Total Employment
Current	0%
300 Additional Mining Employees	81%
400 Additional Mining Employees	85%

Source: (U.S. Census Bureau, 2010-2014f, 2010-2014h)

Table 5 (pp. 70-72) depicts the results of an economic base analysis using data from the block groups in the 50-mile commuting radius from the future mine site. The three industry groups with the highest percentage of workers in the 50-mile radius are the educational services, and health care and social assistance group (26.14%), the retail trade group (11.02%), and the manufacturing group (10.72%). Of these three industry groups, only the retail trade group is not an export industry. Only 0.15% of the current workers in the 50-mile radius work in the mining, quarrying, and oil and gas extraction group. This means that in the 50-mile radius mining is not currently an important source

Table 5 Economic Base Analysis of the 50-Mile Radius

Industry Groups (Categories within industry groups indented)	Data from Block Groups in the 50 Mile Radius				United States		
	Total				Total		
	Estimate	Percentage of Total 50 Mile Radius Estimate	Local Requirement	Export Employment	Estimate	Margin of Error	Percentage of Total US Estimate
Civilian employed population 16 years and over	226,774	100.00%			143,435,233	+/-129,103	100.00%
Agriculture, forestry, fishing and hunting, and mining:	7,965	3.51%	4,438	3,527	2,807,292	+/-13,831	1.96%
Agriculture, forestry, fishing and hunting	7,619	3.36%	3,091	4,528	1,955,033	+/-11,759	1.36%
Mining, quarrying, and oil and gas extraction	346	0.15%	1,347	-1,001	852,259	+/-6,436	0.59%
Construction	13,995	6.17%	13,982	13	8,843,718	+/-33,734	6.17%
Manufacturing	24,313	10.72%	23,645	668	14,955,235	+/-38,544	10.43%
Wholesale trade	5,221	2.30%	6,225	-1,004	3,937,598	+/-14,904	2.75%
Retail trade	24,998	11.02%	26,243	-1,245	16,598,718	+/-30,313	11.57%
Transportation and warehousing, and utilities:	11,444	5.05%	11,173	271	7,066,666	+/-17,821	4.93%

Transportation and warehousing	8,538	3.76%	9,218	-680	5,830,465	+/-16,105	4.06%
Utilities	2,906	1.28%	1,954	952	1,236,201	+/-8,687	0.86%
Information	4,521	1.99%	4,844	-323	3,064,078	+/-15,803	2.14%
Finance and insurance, and real estate and rental and leasing:	15,912	7.02%	14,968	944	9,467,555	+/-30,900	6.60%
Finance and Insurance	13,212	5.83%	10,706	2,506	6,771,721	+/-28,883	4.72%
Real estate and rental and leasing	2,700	1.19%	4,262	-1,562	2,695,834	+/-13,416	1.88%
Professional, scientific, and management, and administrative and waste management services:	17,827	7.86%	24,693	-6,866	15,618,627	+/-35,692	10.89%
Professional, scientific, and technical services	10,926	4.82%	14,932	-4,006	9,444,252	+/-43,936	6.58%
Management of companies and enterprises	66	0.03%	172	-106	109,009	+/-2,228	0.08%
Administrative and support and waste management services	6,835	3.01%	9,589	-2,754	6,065,366	+/-26,403	4.23%

Educational services, and health care and social assistance:	59,275	26.14%	52,644	6,631	33,297,237	+/-115,894	23.21%
Educational Services	26,131	11.52%	21,353	4,778	13,505,830	+/-83,524	9.42%
Health care and social assistance	33,144	14.62%	31,291	1,853	19,791,407	+/-43,517	13.80%
Arts, entertainment, and recreation, and accommodation and food services:	18,188	8.02%	21,518	-3,330	13,610,162	+/-54,578	9.49%
Arts, entertainment, and recreation	4,213	1.86%	4,873	-660	3,082,317	+/-11,919	2.15%
Accommodation and food services	13,975	6.16%	16,645	-2,670	10,527,845	+/-55,024	7.34%
Other services, except public administration	10,251	4.52%	11,245	-994	7,112,579	+/-21,997	4.96%
Public administration	12,864	5.67%	11,155	1,709	7,055,768	+/-32,660	4.92%
Total Export Employment (Categories within industry groups added together instead of industry groups where they exist)				**17,007**			

Source: (U.S. Census Bureau, 2010—2014g; U.S. Census Bureau, 2010-2014h)

of employment. Of the 13 industry groups, 7 are export industries. A large increase in one industry may not have as much effect on the radius area as it would in Elk Creek.

Table 6 (p. 74) depicts the effects of adding both 300 and 400 mining jobs to the market in the 50-mile radius. The percentage of total employment for mining, quarrying, and oil and gas extraction category increases greatly. In addition the location quotients go from 0.257 to 0.471 and 0.541 for 300 and 400 additional mining employees, respectively. This indicates that even while adding 300 or 400 workers to the 50-mile radius, the area will still not be very dependent on mining (U.S. Census Bureau, 2010-2014g, 2010-2014h). If the mine were to close after adding jobs to the economy, there would not be much of an impact. This is likely, in part, due to the fact that there are more jobs in other industry groups in the area. If the mine would close, people may have other jobs options nearby. Those who move into the area for mining jobs would likely have other options if the mine closes. This could be a factor for people deciding where to live. If they have a better chance at obtaining another job if they lose the one at the Elk Creek mine, they may be more inclined to move to areas outside of Elk Creek, rather than to the village where the economy is less diversified. Using the multiplier effect, we see that adding 300 to 400 employees would add between 3,999 and 5,332 employees in other industries to the already 226,774 persons working in the 50-mile radius.

4.4 Earnings

The income of people within the 50-mile radius was examined and compared to the annual mean wage of various occupations in the Metal Ore Mining (NAICS 212200), and Support Activities for Mining (NAICS 213100) categories of the Bureau of Labor Statistics May 2015 National Industry-Specific (NAICS) Occupational Employment and

Wage Estimates. This was done to gain an idea of the number of people who currently earn lower wages than they might if they elect to work for NioCorp. This data was used

Table 6 Effect of Adding 300 to 400 Mining Workers on the 50 Mile Radius

	Multiplier Effect (13.33) of Adding Mining Jobs	Percentage of Total Employment with Additional Employment from Multiplier Effect	Location Quotients for Mining, Quarrying, and Oil and Gas Extraction
Current		0.15%	0.257
300 Additional Mining Employees	3999	0.28%	0.471
400 Additional Mining Employees	5332	0.32%	0.541

Source: US Census Bureau, 2010—2014g; U.S. Census Bureau, 2010-2014h)

because wages for future NioCorp employees at the Elk Creek mine are currently unknown. This gives us an idea of the possible labor force in the 50-mile radius who might be interested in a job with NioCorp. The Bureau of Labor Statistics uses the Standard Occupational Classification system to separate occupations into 3 categories. These include broad occupations, of which there are 461, minor groups, of which there are 97, and major groups, of which there are 23. The major groups classification category was used for the purposes of this analysis. Table 7 (pp. 75-76) indicates that the average annual wage of all 15 occupations found in the major occupation group for Metal Ore Mining was $62,861.33 (Bureau of Labor Statistics, 2015a). Table 8 (pp. 77-78) shows that the average annual wage of all 19 occupations found in the major occupation

Table 7 Bureau of Labor Statistics May 2015 National Industry-Specific (NAICS) Occupational Employment and Wage Estimates for Metal Ore Mining (NAICS 212200)

Standard Occupational Classification occupation code	Standard Occupational Classification occupation title	Group	Employment	Employment relative standard error	Percent of total employment	Annual mean wage	Mean wage relative standard error
47-0000	**Construction and Extraction Occupations**	major	15,200	8.0%	33.39%	$54,980	2.1%
49-0000	**Installation, Maintenance, and Repair Occupations**	major	9,520	5.4%	20.92%	$57,080	1.9%
51-0000	**Production Occupations**	major	6,180	6.4%	13.57%	$51,280	2.9%
53-0000	**Transportation and Material Moving Occupations**	major	4,850	7.9%	10.66%	$45,760	2.4%
17-0000	**Architecture and Engineering Occupations**	major	3,230	5.6%	7.09%	$77,970	1.3%
19-0000	**Life, Physical, and Social Science Occupations**	major	1,780	7.8%	3.90%	$63,910	2.5%
43-0000	**Office and Administrative Support Occupations**	major	1,470	5.0%	3.22%	$45,950	2.3%
11-0000	**Management Occupations**	major	1,200	6.0%	2.63%	$125,750	2.6%
13-0000	**Business and Financial Operations Occupations**	major	1,150	7.8%	2.52%	$71,550	1.7%
29-0000	**Healthcare Practitioners and Technical Occupations**	major	280	5.4%	0.61%	$69,560	1.6%

33-0000	**Protective Service Occupations**	major	280	9.4%	0.62%	$42,560	3.0%
15-0000	**Computer and Mathematical**	major	170	7.8%	0.37%	$70,380	1.8%
	Occupations						
37-0000	**Building and Grounds Cleaning and Maintenance Occupations**	major	110	16.7%	0.25%	$37,720	3.9%
27-0000	**Arts, Design, Entertainment, Sports, and Media Occupations**	major	50	27.9%	0.11%	$63,480	5.8%
41-0000	**Sales and Related Occupations**	major	30	22.3%	0.08%	$64,990	8.0%
	Total Annual Mean Wage					$942,920.00	
	Average Annual Mean Wage					$62,861.33	

Source: (Bureau of Labor Statistics, 2015a)

Table 8 Bureau of Labor Statistics May 2015 National Industry-Specific (NAICS) Occupational Employment and Wage Estimates for Support Activities for Mining (NAICS 213100)

Standard Occupational Classification occupation code	Standard Occupational Classification occupation title	Group	Employment	Employment relative standard error	Percent of total employment	Annual mean wage	Mean wage relative standard error
47-0000	**Construction and Extraction Occupations**	major	214,190	1.7%	50.97 %	$49,610	1.0%
53-0000	**Transportation and Material Moving Occupations**	major	51,920	3.5%	12.35 %	$45,120	1.4%
49-0000	**Installation, Maintenance, and Repair Occupations**	major	31,020	4.8%	7.38%	$49,990	3.1%
43-0000	**Office and Administrative Support Occupations**	major	29,050	2.2%	6.91%	$39,930	1.5%
51-0000	**Production Occupations**	major	27,950	6.3%	6.65%	$47,100	1.5%
11-0000	**Management Occupations**	major	17,090	2.6%	4.07%	$129,980	1.7%
17-0000	**Architecture and Engineering Occupations**	major	13,660	6.6%	3.25%	$95,560	4.4%
13-0000	**Business and Financial Operations Occupations**	major	10,880	6.7%	2.59%	$79,220	2.2%
19-0000	**Life, Physical, and Social Science Occupations**	major	8,180	11.4%	1.95%	$71,910	5.9%

41-0000	**Sales and Related Occupations**	major	8,180	5.6%	1.95%	$83,050	3.3%
15-0000	**Computer and Mathematical Occupations**	major	3,310	10.8%	0.79%	$94,850	4.1%
29-0000	**Healthcare Practitioners and Technical Occupations**	major	2,460	5.8%	0.59%	$67,700	1.7%
37-0000	**Building and Grounds Cleaning and Maintenance Occupations**	major	950	25.3%	0.23%	$26,020	3.4%
23-0000	**Legal Occupations**	major	610	16.4%	0.15%	$118,820	7.7%
27-0000	**Arts, Design, Entertainment, Sports, and Media Occupations**	major	280	26.9%	0.07%	$77,360	3.6%
35-0000	**Food Preparation and Serving Related Occupations**	major	260	20.3%	0.06%	$30,460	7.8%
33-0000	**Protective Service Occupations**	major	90	16.7%	0.02%	$42,410	10.1%
45-0000	**Farming, Fishing, and Forestry Occupations**	major	50	21.6%	0.01%	$55,900	7.5%
25-0000	**Education, Training, and Library Occupations**	major	(8)	(8)	(8)	$93,590	5.6%
	Total Annual Mean Wages					$1,298,580.00	
	Average Annual Mean Wages					$68,346.32	

Source: (Bureau of Labor Statistics, 2015b)

group for Support Activities for Mining is $68,346.32 (Bureau of Labor Statistics, 2015b). These two figures tell us the average annual wage for those working in ore mining occupations and those in supporting mining occupations. This can be compared to the wages earned by those within 50 miles of the future mining site to gain an idea of the size of the labor force earning as much or less than the average earned in metal ore mining occupations and those in supporting mining activities.

Table 9 (p. 80) shows the 2010-2014 American Community Survey 5-year estimates for the Earnings In The Past 12 Months (In 2014 Inflation-Adjusted Dollars) table. This data was originally separated by sex. It was added together for each block group intersecting a 50 mile radius of the coordinates for the site given in the Preliminary Economic Assessment. The combined estimate for all people in the $55,000 to $64,999 range or lower in the 50 mile radius is 222,161 (U.S. Census Bureau, 2010-2014c). The combined estimate for all people in the $65,000 to $74,999 range or lower in the 50 mile radius is 231,409. NioCorp only needs 300 to 400 permanent employees for their new mine. This indicates that there are more than enough people living within 50 miles of the site whose wages are lower than they might be paid working for NioCorp. These people will likely be more willing to leave their jobs for a position at NioCorp than someone earning more than what they might be paid working at the mine. Many future NioCorp employees working at the mine could come from those living within 50 miles of the site. This, combined with the stated desire of NioCorp to hire locally, shows that there should be a local labor force for NioCorp to pull from. This does not mean that people will not move into the area to take advantage of job opportunities and add to that labor force. Some people would likely be needed to replace those leaving their current jobs. However, the data tells us that NioCorp jobs will potentially be high paying and many

people may be interested. Some positions may require a higher level of skill, training, or education. These positions may require the hiring of someone outside of the local area. However, it is safe to assume from this data that many local people will be hired by NioCorp to work at the mine.

Table 9 Earnings in the Past 12 Months (In 2014 Inflation-Adjusted Dollars) in the 50-mile Radius

Amount of Earnings	Estimated Number of People	Margin of Error
$1 to $2,499 or loss	20,400	978
$2,500 to $4,999	14,366	772
$5,000 to $7,499	14,283	821
$7,500 to $9,999	9,471	672
$10,000 to $12,499	12,428	737
$12,500 to $14,999	8,866	628
$15,000 to $17,499	10,004	651
$17,500 to $19,999	7,384	554
$20,000 to $22,499	12,037	705
$22,500 to $24,999	7,700	561
$25,000 to $29,999	18,599	860
$30,000 to $34,999	18,924	821
$35,000 to 39999	15,486	737
$40,000 to $44,999	15,789	737
$45,000 to $49,999	10,442	569
$50,000 to $54,999	12,117	640
$55,000 to $64,999	13,865	648
$65,000 to $74,999	9,248	538
$75,000 to $99,999	12,610	611
$100,000 or more	12,438	596
Total Estimate	2**56,457**	

Source: (U.S. Census Bureau, 2010-2014c)

4.5 Labor Force Analysis

Table 10 (p. 81) shows the labor force and unemployment statistics for Elk Creek, Nebraska. This data comes from the 2010-2014 American Community Survey conducted by the U.S. Census Bureau (U.S. Census Bureau, 2010-2014d). It should be noted that the data listed here are estimates and are not exact. Therefore, the estimates may be

different than the actual statistics of Elk Creek. The data shows that 67.3% of the population 16 years and over is in the labor force. This would equal about 70 people. The number of employed people is the same. The unemployment rate is 0%. The job market in Elk Creek is small due to the small number of people living in the community. The fact that the estimated unemployment rate is 0% means that the market is tight. This means there are not many workers to fill jobs that open up in the community. Therefore, any new jobs are likely to be filled by those from outside. This could be those looking to commute or those moving to the community. In order to determine how likely it is that workers commute, it is important to look at the larger area. It should be noted that the margin of error for the unemployment rate is high, meaning the data is not particularly reliable. However, due to the small size of the community, we can assume that the labor force would be small and that the community would need people from the outside to fill additional jobs in the community that would result from the mine. This analysis, although not entirely accurate, was completed just to demonstrate what would likely happen in the community.

Table 10 Labor Force, Employment, and Unemployment Rate in Elk Creek, Nebraska – ACS 5-year data 2010-2014

Subject	Elk Creek village, Nebraska							
	Total		Percentage in labor force		Percentage employed		Unemployment rate	
	Estimate	Margin of Error	Estimate	Margin of Error	Estimate	Margin of Error	Estimate	Margin of Error
Population 16 years and over	104	+/-36	67.3%	+/-16.5	67.3%	+/-16.5	0.0%	+/-24.5

Source: (U.S. Census Bureau, 2010-2014d)

Table 11 (p. 83) depicts labor force and unemployment data from the 2010-2014 American Community Survey for the 50 mile commuting radius. This data comes from the 2010-2014 American Community Survey conducted by the U.S. Census Bureau. It should be noted that the data listed here are estimates and are not exact. Therefore, the estimates may be different than the actual statistics of a 50-mile radius. The data shows that 69.9% of the population 16 years and over is in the labor force. The number of people participating in the labor force is estimated to be 240,484. The number of employed people is at 65.9% (U.S. Census Bureau, 2010-2014e). The unemployment rate is 5.5%. This means that like Elk Creek, the job market in the 50-mile radius is tight due to the low unemployment rate. This would normally mean that there are not many workers to fill jobs that open up in the community. However, the labor force in the area is large (240,484). There are enough unemployed people (13,235) in the 50-mile radius to fill the mining jobs and the 3,999 to 5,332 additional jobs that appear as a result (U.S. Census Bureau, 2010-201e). This does not mean that people will not move into the 50-mile radius in order to try to take advantage of jobs opportunities. However, it does mean that the 50-mile radius region has the capacity to fill jobs, further reducing the possibility of people moving into the Elk Creek community. This, of course will depend upon the skill requirements for the jobs in question. The exact skill level of each job at the Elk Creek mine is unknown. However, if the job is a higher skill job and cannot be filled by someone who is trained by NioCorp, such as one requiring a college degree, there is a higher likelihood that someone from outside will be needed who is used to doing the type of job required. There may be limitations for hiring people in the local region, but in general, if people in the 50-mile radius can keep living where they are and commute, they likely will do so, especially if they live in a larger community where more opportunities

exist for their families. This was observed in the fly-in-fly-out communities of Australia. People did not move to the rural communities where the mines were located, in part, because those communities did not offer as much opportunity for families as the larger communities (Carrington & Pereira, 2011). However, it is worth noting that mining jobs are often fairly high-paying, meaning that people might be willing to leave their current jobs to work at the mine. Regardless, the data reveals that it is likely that a substantial number of people will move into the area to take advantage of mining jobs available due to the lack of unemployed workers in the area.

Table 11 Labor Force, Employment, and Unemployment Rate in the 50-Mile Commuting Radius

Subject	50 Mile Radius						
	Total population estimate	**In labor force estimate**	**Percentage in labor force estimate**	**Employed estimate**	**Percentage employed estimate**	**Unemployed estimate**	**Unemployment rate estimate**
Population 16 years and over	343,873	240,484	69.9%	226,774	65.9%	13,235	5.5%

Source: (U.S. Census Bureau, 2010-2014e)

4.6 Housing Analysis

Finally, a housing analysis was conducted for both Elk Creek and the 50-mile radius in order to determine what the housing stock looked like in each area. This can help determine the likelihood of mine workers moving into the area picking Elk Creek as a place to live. Table 12 (p. 84) shows the 2010-2014 American Community Survey estimates for housing occupancy in Elk Creek, Nebraska. The data reveals that there are an estimated 76 housing units in Elk Creek. Most of those are estimated to be occupied, while 6 units (7.9%) are vacant. Comparing this to the data conducted from the housing survey in Elk Creek conducted by the author of this thesis (Table 13, p. 84), we see the

estimates predict quite a few more housing units than the 53 counted in survey. However, the margins of error for the number of housing units in the Census data indicate that the information collected in the survey could be correct. An examination of the 2010 decennial census data in Table 14 (p. 85) shows there were 47 occupied units, 10 vacant, and 57 total in Elk Creek. These numbers are fairly close to those obtained from the housing survey. Therefore, it is safe to say the housing stock has not changed much, if at all, since the 2010 decennial census. This information reveals that there will be a need to increase the housing stock in Elk Creek in the event of a major population increase. However, the availability of housing in the area could affect the number of people that move to Elk Creek.

Table 12 Number of Occupied and Vacant Housing Units in Elk Creek, Nebraska: 2010-2014 American Community Survey

Subject	Elk Creek village, Nebraska			
	Estimate	Margin of Error	Percent	Percent Margin of Error
HOUSING OCCUPANCY				
Total housing units	76	+/-25	76	
Occupied housing units	70	+/-25	92.1%	+/-8.3
Vacant housing units	6	+/-6	7.9%	+/-8.3

Source: (U.S. Census Bureau, 2010-2014i)

Table 13 2016 Elk Creek Housing Survey Results: Number of Housing Units in Elk Creek

Type of Housing Unit	Number of Units	Notes
Traditional Single Family Homes	46	
Mobile Homes	5	
Apartment Buildings	2	Low Income Housing
Total	**53**	

Source: (Data Collected by Bogle, 2016a)

Table 14 Number of Housing Units in Elk Creek: 2010 Census

	Number of Housing Units	Percent of Total Housing Units
Occupied Housing Units	47	82%
Vacant Housing Units	10	17%
Total Housing Units	**57**	**100%**

Source: (U.S. Census Bureau, 2010a)

Table 15 Number of Occupied and Vacant Housing Units in the 50-mile Radius: 2010 -2014 American Community Survey

Subject	50 Mile Radius	
	Estimate	Percent
HOUSING OCCUPANCY		
Total housing units	205,804	205,804
Occupied housing units	188,880	91.8%
Vacant housing units	16,924	8.2%

Source: (U.S. Census Bureau, 2010-2014j)

Table 15 shows the 2010-2014 American Community Survey estimates for housing occupancy in the 50-mile radius. The data reveals that there are an estimated 205,804 housing units in the radius. Most of those are estimated to be occupied, while 16,924, or 8.2% of the units are vacant. The estimates reveal that there are enough vacant housing units in the 50-mile radius to accommodate additional population migrating to the area to fill between 3,999 and 5,332 jobs (U.S. Census Bureau, 2010-2014j). This makes it more likely that those moving into the area will move to other places within the

50-mile radius due to the fact that housing is available in the area. This will likely reduce the number of people that move to Elk Creek.

There are a few problems the local communities, such as Elk Creek, could run into. First, Wilson (2004), indicates that communities near the lead mine in Missouri were not affected as much by the changing prices of the commodities at the mine due to the fact that there was more than one mine location. At the NioCorp mine, there will only be one mine shaft and one location. Wilson (2004) indicates that this may have been a problem for the Michigan mine because it forced the mine workers to concentrate in one location so they could live near the mine. Again, having one mine location will not be as much of a problem for the NioCorp mine because of the close proximity to larger communities, such as Lincoln, as well as a large enough potential workforce nearby. Another possible problem for the Elk Creek mine is the inability to adapt to price changes by focusing on more productive mines as the Missouri mine did (Wilson, 2004). However, the NioCorp mine will be producing multiple commodities (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). Lawrie, Tonts, and Plummer (2011, p. 142) state that "volatile global commodity markets can exacerbate the vulnerability of local workers. This is particularly true for single-commodity towns, especially those focused on resources such as tin, coal, copper and iron ore." The Elk Creek mine will be mining more than one commodity, but it will not be mining any of the commodities listed in the article, and the prices of its most important commodities are not particularly volatile. Therefore, the local Nebraska communities, including Elk Creek, and their workers should be less vulnerable, as the mine should be less vulnerable to needing to adjust to commodity prices through layoffs at the mine.

Chapter 5: Scenarios

5.1 Introduction

This chapter outlines three different scenarios for Elk Creek as a result of the future mine. These scenarios are created under the assumption the mine will be built and will hire 1,200 people for construction and 300 to 400 people for permanent mining jobs (J. Sims, personal communication, February 16, 2016). These scenarios offer suggestions about what will happen in Elk Creek based upon the scenario outlined. Scenarios 1 and Scenario 2 offer examples of extreme boom scenarios. These are included in order to compare them directly to Scenario 3, which offers a look at the most likely scenario for Elk Creek based upon the data collected and analyzed in Chapter 4 (p. 53). Suggestions for housing options for both temporary construction workers and permanent mine employees are given for each scenario.

5.2 Scenario 1

One extreme scenario for Elk Creek is that all 1,200 temporary workers hired for construction and all 400 permanent employees will move to Elk Creek. Under this scenario, it is assumed that all workers, whether local or from outside the 50-mile radius, move to Elk Creek to take advantage of its proximity to the mine site. It will be difficult to house all of the people required for the construction phase. This phase is estimated to last about two years and will require different numbers of construction workers at different times. At its peak, the construction phase will require 1,200 workers (J. Sims, personal communication, February 16, 2016). Therefore, there will only be 1,200

construction workers there for a short period of time. It is unknown when the number of workers might peak, or when the numbers will steadily rise and fall around the peak. The construction is estimated to begin either at the end of 2016 or the beginning of 2017 (J. Sims, personal communication, February 16, 2016). Assuming a steady rise and fall of the number of construction workers needed, and assuming construction begins sometime in the last quarter of 2016, we can assume that we would see 1,200 construction workers in the final quarter of 2017. This means that the number of construction workers at the Elk Creek site would steadily rise from the end of 2016 to reach a peak of 1,200 at the end of 2017, with a steady decrease in workers until the construction is finished at the end of 2018. As production is predicted to begin in 2018, and a conditioning period is required before production begins, there may be some overlap between the times construction workers and permanent workers are at the mine (J. Sims, personal communication, February 16, 2016) (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). Because construction activities are temporary by nature, temporary housing will be needed for the construction workers.

As we can see from Table 14 (p. 85) the number of vacant housing units in Elk Creek in 2010 was 10 (U.S. Census Bureau, 2010a). Therefore, there are not many options for offering rental properties to the construction workers in Elk Creek. As a result of this fact, there would be three main options available to Elk Creek for housing construction workers. One would be to convert the vacant school building to apartments. As mentioned previously, the North Dakota, federal, and Williston, North Dakota governments spent $10.6 million on converting an old school building into senior housing in Williston (Industrial Commission of North Dakota, 2012). Although the exact cost of doing this is unknown, it would no doubt be an expensive endeavor to convert the

school building to housing in Elk Creek, as well. However, it would likely be worth it because no new buildings would need to be built to provide the housing that could be created through the conversion. However, this would likely not offer enough units to house all of the construction workers needed for the mine. Therefore, an implementation of other housing option would likely be needed. An additional option would be to provide space for the construction workers to park RVs. Offering amenities such as indoor RV housing, as discussed in Chapter 3 (p. 26), would not be likely because, if built like the park in North Dakota, it would use permanent structures, and it is unknown if these buildings would be needed if a bust situation were to occur. Without campground areas made for RVs, dealing with sewage and water needs might be difficult to offer those living in these vehicles.

Another option would be to offer crew camp housing. NioCorp currently has no plans to offer company housing to employees (J. Sims, personal communication, February 16, 2016). If all construction workers chose to live in Elk Creek, it is likely that the crew camps would be built by a private firm to house these workers, as we have seen done in North Dakota (Ellis, 2011c). Doug Goracke, who is in charge of electric, public properties, streets, economic development, and building and maintenance code for the City of Tecumseh, Nebraska, explained that companies were already interested in building crew camps in the area (D. Goracke, personal communication, February 23, 2016). This would likely be built on land near the community, but outside of the corporate limits on a nearby farm as the land inside the corporate limits would likely be used for building housing for more permanent workers. The company that would build the temporary housing would likely rent a suitable site from a local farmer. Housing could be built incrementally, until enough units for 1,200 workers were built; then this

number could be reduced. As workers moved in to take advantage of permanent jobs, they could temporarily fill some of the units until other housing was built. Mobile homes could also be an option for temporary workers. They could also provide a cheap housing option for the people moving into the area on a permanent basis after they are no longer used by the temporary workers. However, the exact number of units needed, while unknown, would need to fairly large to accommodate both the 400 permanent mine employees and the additional people added due to the multiplier effect. This may make it impractical to use this option, as accommodating hundreds of mobile homes in a small community could prove difficult.

As mentioned above, adding 400 permanent mine workers to a community would increase the population even further as more jobs are added due to the multiplier effect and as workers and their families move in to the community. The multiplier effect is not calculated for Elk Creek due to the fact that the small size of the village creates a large margin of error, meaning the estimate would not be very accurate. However, the multiplier effect for the 50- mile radius in this scenario would be 5,332 people. The 50-mile radius contains an estimated 16,924 vacant housing units. This number does not account for the price or condition of the units. Depending upon these variables, the number of available units could be less. However, the 50-mile radius would be able to accommodate the extra 5,332 people moving to the area since Elk Creek likely could not accommodate that large of a number.

The mine is expected to produce materials for at least 32 years, if not longer (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). In addition, the historical stability of the prices of niobium, and the fact that the mine produces more than one commodity reduces the risk that the mine may close or that workers may be laid off over

that time (USGS, 2015a) (Lawrie, Tonts, and Plummer, 2011). This increases the likelihood that people would be moving into Elk Creek permanently and would bring their families. This means more permanent housing would be needed. In most cases, as stated previously, a large number of temporary workers would require more temporary housing. However, while some temporary housing will be necessary, it would benefit the community to offer permanent rental units to the temporary workers. As they begin to leave the community and the permanent workers move in, it would allow them to take the place of the construction workers. The temporary workers will likely not bring their families with them, while the permanent workers might. In order to make sure the community does not overbuild, they can offer some permanent housing supplemented with some temporary housing. The temporary units could then be removed when they are no longer needed. The utilities in Elk Creek, especially the water system, would need to be upgraded, as the water system currently in Elk Creek has the capacity to serve only 497 people (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). The upgrade could be done by buying more water from the Johnson County Rural Water District Number 1 to add to the 80,000 gallons per month they already buy. They could also add more community wells. Any housing expansion would need to be added to the north or northeastern portions of the community due to the limitations from the floodplain (Figures 10 & 11, pgs. 23 & 24) (National Flood Insurance Program, 2006a; National Flood Insurance Program, 2006b) (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015).

Several housing options would be available to Elk Creek as a result of population increase in the community. These would include many of those mentioned previously in Chapter 3 (p. 26), including building micro-apartments, or townhomes, subsidizing

construction using funding obtain from programs like the Nebraska Affordable Housing Program or the HOME Investment Partnership Program, or mobile homes. Townhomes and micro-apartments are not a style of housing usually found in rural communities. However, only 16.27 vacant acres are available within the city limits for development (Stahr & Associates Community and County Planning Associates and JEO Consulting Group, Inc., 2000). Fewer acres than that are available, because, through eyeballing the current land use map, we can see that a little less than half of the acres are not viable for housing development due to flooding risk and the fact that it is in a more industrial area of the community. If we say that 6 .27 acres are in flood risk areas, that leaves 10 acres for housing development. Knowing that there are currently about 2.5 housing units per acre in the land used for residential purposes in Elk Creek, we can calculate that roughly 25 traditional housing units would fit within the corporate limits of the community (Stahr & Associates Community and County Planning Associates and JEO Consulting Group, Inc., 2000). Again, it should be stated that this is a very rough estimate. De Chiara, Panero, and Zelnik (1994) recommend in their book, *Time-Saver Standards for Housing and Residential Development*, that single family detached homes be built at a density of 5 units per acre. This is double what is currently seen in Elk Creek. This means that 50 units would be possible in the available 10 acres. As this could only accommodate 50 families, they would need to expand beyond the current borders of the community. Building townhomes or apartments would save space in the community due to the fact that more units can be built in a smaller space because they are connected. At a recommended 16 units for single family detached or 2-family semidetached units, you would be able to fit 160 units, and about the same number of families in the existing community borders (De Chiara, Panero, and Zelnik, 1994). The community would still

need to build outside of its borders to the northeast. With apartments, buyers also do not have the larger expense of buying a home. The number of apartments that would be available to be built within the current village limits is between 250 and 850 units depending upon the number of stories built between 2 and 13 (De Chiara, Panero, and Zelnik, 1994). Large apartment buildings normally are not built in rural communities. In addition, while they are permanent buildings, they do not have the potential for offering home ownership. Therefore, it is probably more realistic to mix a few 2-story and 3-story apartment buildings with townhomes and some traditional housing, as well. However, it would benefit the community to build apartments and temporary housing, such as man camps first, and wait and see how many people are willing to move into the community permanently before they build a great deal of other types of permanent housing.

NioCorp needs space for employees, and with the addition of new jobs, Elk Creek will probably need to expand their city workforce. This allows the two entities to work together to build these apartment units. This could be done through a process in which NioCorp builds the apartment building, and Elk Creek subsidizes it by obtaining funds through a project like the Nebraska Affordable Housing Program. However, due to the fact that NioCorp has expressed that they do not plan to build a separate housing area for their employees, it is probably more likely that private developers are relied on to build new housing units (J. Sims, personal communication, February 16, 2016). Regardless of how they are built, constructing apartment buildings will be a great benefit to the community in this scenario.

If Elk Creek does not provide housing for NioCorp's employees, there would be here options. First, the company can build housing. Second, they can rely on private companies to build housing. Finally, the workers can build their own housing. Due to

the fact that NioCorp has expressed that they do not plan to build company housing, the most likely scenario would be to rely on private developers for housing construction. NioCorp would need to determine how much housing they believed they would need and work with the private developers to meet those needs.

New apartments in Elk Creek would allow NioCorp to house temporary workers during the construction phase, while also housing permanent workers during the production phase. Apartment buildings would start being built at the beginning of the construction period or sooner, if possible. This would allow for permanent structures to be built, while also offering temporary units to temporary employees. It would integrate permanent employees into the community at a quicker pace, rather than having them live in RVs or crew camps until housing was built. It would also prevent housing prices from rising as high, and would provide an option cheaper than buying a traditional home. As miners begin to settle into the community, other housing, such as traditional single family houses, can be integrated into the community to offer a variety of housing options.

Offering apartments to both temporary and permanent workers would decrease the amount of temporary housing needed in Elk Creek. As stated in the previous paragraph, it would integrate miners into the community faster, which would allow for industries and businesses outside of mining to form. Creating these industries and businesses is the key to the success of the community in the event of a bust or economic downturn at the mine (Labonne, 1999). If other industries and businesses are established and a great number of people have jobs in the community that are not directly tied to mining, they will be more likely to stay in the event of economic troubles at the mine (Labonne, 1999). As the economy will become less diversified through the addition of mine workers, adding industries independent from the mine, workers in those industries

and businesses without ties to mining can create more diversity again and allow for other job opportunities in the community. Although the NioCorp mine is likely to have stable prices for the products mined, and will likely not be volatile economically, it is best to establish economic diversity in the community as early as possible just in case something bad would happen to the mine. This is why having apartments already built is important so new residents can move right in and be a part of the community.

In the event of a bust in this scenario, the community has to be careful. If a bust happens early, many people would likely move out of Elk Creek in search of new jobs, as not many other jobs would be available in the village. This is why it is important to be careful not to build too many permanent structures early. If the bust happened later in the lifetime of the mine and the community had not worked to diversify its economy, people would likely leave for new job opportunities elsewhere and leave the community with empty permanent structures. That is one risk of integrating temporary workers into the community and assuming that permanent workers will replace them. However, if permanent housing is not available for the permanent workers when they arrive, you deal with housing shortages, and prices become too high for people to afford housing. If Elk Creek had worked to diversify the community's economy by adding additional industries separate from mining, if a bust happens, some people would likely move out, but others if they have a job that is not attached to mining, may choose to stay. This would decrease the risk of building permanent housing early on.

5.3 Scenario 2

A second boom scenario is the extreme opposite of Scenario 1. In this scenario, 1,200 construction workers and only 100 permanent mining employees would move into

the area. The approach to providing housing for 1,200 construction workers would change slightly. The school could still be converted to apartments, but rather than integrating the temporary workers into the community through apartment buildings, it would be beneficial to use a combination of crew camps and mobile homes. Adding 100 mining jobs instead of 400 would greatly decrease the number of additional jobs added as a result of the multiplier effect. The result would be a much more manageable number of people than in the previous scenario. The number of housing units needed would be significantly less. As stated in the previous scenario, the multiplier effect for Elk Creek was not calculated because the small size of the community lends itself to an inaccurate estimate. A more accurate estimate comes from the 50-mile radius. In this scenario, the multiplier effect for the 50-mile radius would be 1,333. This number is more manageable, than 5,332, especially for a 50-mile region. However, only a portion of those 1,333 people would live in Elk Creek in this scenario.

It would be wise to leave some temporary housing from the construction phase in order for permanent workers to temporarily move to the area and gain an idea if they want to live there permanently and bring their families to the community. People could be integrated into the community more slowly than in the previous scenario. This would be necessary due to the large discrepancy in the need for temporary housing versus permanent housing. In the previous scenario, the same type of housing could serve both types of workers. However, in this scenario, temporary housing will be needed for the 1,200 construction workers, but permanent housing will only be needed for the fewer permanent workers. Permanent housing, such as traditional housing, could be built as the workers established themselves. Building an apartment building is not a great idea in this scenario, as the slow integration allows time for a bust to occur. In other words, bringing

people into the community at a slower rate means that other industries and businesses will not be created as quickly, leaving Elk Creek vulnerable to bust. In the event that commodity prices fall and the mine falters or fails, the mine employees will likely leave Elk Creek due to the lack of job independent of the mine and the community will be stuck with an empty apartment building. In this scenario, the utilities in Elk Creek would need to be examined for expansion, but they would probably only need minor upgrades, especially the water system, which has the capacity for 497 people (Stahr & Associates Community and County Planning Associates and JEO Consulting Group, Inc., 2000).

Another solution is to construct manufactured, or mobile homes. These are a more viable option in this scenario than the previous one, as they often only contain one or two families and fewer would likely be needed. De Chiara, Panero, and Zelnik, (1994) recommend providing 25 mobile units for every four acres and grouping them in 25 unit sections. This means that they recommend 6.25 units per acre. In the 10 residential acres available there would be capacity for 62.5 units in the village limits. Therefore, the additional units would need to be built outside of the village boundary limits. These might fit well in the community due to the fact that they can be constructed quickly and are cheap. As people move into the community, housing shortages will raise housing costs. Keeping crew housing will help lower prices, but they are only a temporary solution. Mobile homes would be a cheaper, more permanent solution. They can also be erected quickly, to offer more housing options without needing to wait as long. However, a large number of mobile homes, as stated above, may draw the ire of locals, although they are allowed with a special use permit in Johnson County in Agricultural Residential Districts (Johnson County, Nebraska, n.d.). These could serve a similar purpose as crew camps, but with the added bonus of also being more permanent. They

could be replaced later by traditional housing. They could also be used in place of crew camps by construction workers early on, while allowing permanent residents to move in later. This would also reduce the risk of building permanent housing, as they can be moved from the spot they sit on when they are no longer needed. This would give people the option of living in cheaper manufactured housing or in traditional housing.

In addition, they could be built incrementally. It is possible that smaller units could be erected in a rapid manner to deal with the initial rush of people coming into the community. After the rush had calmed down, people could choose to build more traditional permanent housing, or build onto the mobile homes as they see fit, using additional modular style housing. As this type of housing can last for a long time, it is a viable solution for families to keep the structures they already live in and improve them. One example of incremental housing is the "colonias, informal subdivisions along the U.S. border region with Mexico," mainly in Texas (Mukhija, 2014, p. 13). Mukhija states that modular homes are a popular type of building used in these communities. The article states that "these initial homes serve as a core for future incremental additions and extensions and for extensive do-it-yourself and self-help improvements to the interiors of the homes and yard areas," (Mukhija, 2014, p. 13). Although the people looking for homes in Elk Creek may not be low-income, they will still be looking for lower priced housing units as prices will rise when demand for housing increases and supply decreases. Using a similar process to the colonias would allow Elk Creek to offer cheap housing that can be constructed cheaply, but can also serve as both a temporary and permanent housing solution. It would give the community time to catch up with the population increase and determine how much permanent housing was needed, while preventing the risk of providing a great deal of permanent housing early on and risking a

bust situation. These units would likely be placed in the northeastern or eastern portion of the community indicated on the Future Landuse Plan Map in the comprehensive plan (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). As this area is likely not large enough for all additional units needed in the community, they would likely need to be placed in areas that would need to be annexed and lie adjacent to the northeastern or eastern portions of the village. This is due to the fact that flooding is a problem in other areas near the village, as indicated in Figure 10 (p. 23) and Figure 11 (p. 24).

In the event of a bust in the community, the temporary structures built could be removed. With fewer new people and jobs entering the community, it would be less dependent on mining. However, there would also be fewer job opportunities available in the community. Therefore, it is likely that people would move out in the event of a bust and look for new jobs. However, if few permanent structures are built until it is obvious they are needed, the temporary structures can be removed and the community can move on as it did before the boom and bust.

It should be noted that in this scenario, the larger 50-mile radius would likely absorb the additional workers needed for the mine, as there would be more housing and more amenities available in the wider region and larger communities in the region. There would likely be more job opportunities for families of miners in the region as well.

5.4 Scenario 3

In the third scenario, I outline what is likely to happen in the community using the calculations completed in Chapter 4 (p. 53). Temporary housing for construction workers is likely to be constructed by private developers. It will likely consist of crew camps, as in the other scenarios. However in this case, the crew camps may be built in other

communities, depending upon the preference of the private developer. In larger communities in the 50-mile radius, new apartment buildings could be built, or existing ones could also be used to house temporary workers. These buildings could then be used to house permanent workers after the temporary workers leave.

The price of the commodities mined can influence the success of a mine and whether a bust might occur in a mining community. Figure 21 (p.60) shows that the price of ferroniobium was fairly stable from 1980 to 2005 (USGS, 2015b). Papp (2013) explains that Brazil has been able to influence the price of niobium. This is due to the fact that they produce about 90% of the niobium produced in the world (Papp, 2016). In addition, an increase of 5% consumption of niobium was expected in 2015 (Papp, 2015). This means the demand will increase. The stability of prices and increase in demand suggest that the mine prices and jobs might be stable.

Figure 22 (p.62) shows that the price of scandium has fluctuated more from 1980 to 2010 than the price of niobium did (USGS, 2015c. Only 10 to 15 tons of scandium are produced in the world per year (Gambogi, 2013). Models created by Dr. Andrew Matheson and included in the NioCorp's Preliminary Economic Assessment indicate that the demand of scandium is expected to increase in the future and that as production at the Elk Creek mine starts, the price will initially decrease and then increase over the next few years close to the original price (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015). This also seems to indicate a low chance of low commodity prices causing the mine to close.

Figure 23 (p.64) shows that the fluctuation of titanium price is fairly low between 1980 and 2010. In addition, titanium is a byproduct of mining scandium and niobium

and may not influence the mine as much as the other two commodities if prices fall (SRK Consulting, Inc., and Roche Ltd., Consulting Group, 2015).

The evidence shown in the graphs seem to suggest that the prices of the commodities at the Elk Creek mine will be fairly stable. This means that the jobs will likely be stable as layoffs will not be necessary in order to keep the mine going. This allows mine employees to feel more comfortable in their job security. In addition, the mine is projected to last for at least 32 years. Mine employees may be more likely to bring their families to the area and relocate permanently if they believe they can have a stable long term job. This means that it is possible that it is likely that many mine workers will move to Nebraska with their families looking for a stable job.

The wages currently made by people in the area can indicate their possible willingness to work for the Elk Creek mine. While many factors play into the willingness to work for a certain company or in a current job, if a person can make more money in another job, they may be willing to switch careers. If more local people are willing to work for the mine, fewer from outside will be needed, reducing the number of people that would move to Elk Creek. Table 7 (p. 75-76) shows that the U.S. annual average mean wage for metal ore mining jobs is $62,861.33 (Bureau of Labor Statistics, 2015a). Table 8 (pp. 77-78) indicates that the annual average mean wage for jobs in support activities for mining is $68,346.32 (Bureau of Labor Statistics, 2015a). Table 9 (p. 80) shows that an estimated 222,161 people earn wages between $55,000 and $64,999 while an estimated 231,409 people earn wages between $65,000 and $74,999 (U.S. Census Bureau, 2010-2014c). This indicates that there is a large number of locals that the mine can possibly draw from, meaning that it is not necessary to hire exclusively from outside.

However, some people from outside will need to be hired as there may not be enough people with the skill level to do certain jobs at the mine site.

Table 4 (p. 69) shows that the percentage of total jobs for the mining industry in Elk Creek would be 81% and 85% from adding 300 and 400 mining jobs respectively This means that the community would be extremely dependent upon the mining industry for employment. This is to be expected, since the community is so small. This shows that the economy of Elk Creek is not very diverse when you add 300 or 400 mining jobs to the community. With the multiplier effect included, adding 300 or 400 miners would add a lot more jobs, and by extension, people to the community. The 50-Mile radius (Table 5, pp. 70-72) (U.S. Census Bureau, 2010-2014g, 2010-2014h) is somewhat diverse economically, with 7 of the 13 industry groups being exports. It is still quite diverse even after the miners come in, indicating that the 50-mile radius would be able to withstand a bust situation following a boom better than Elk Creek could. The 50-mile radius region would grow by 3,999 or 5,332 jobs by adding 300 or 400 mining jobs, respectively (Table 6, p. 74) (U.S. Census Bureau, 2010-2014g, 2010-2014h).

Looking at the labor force of an estimated 104 persons in Elk Creek, we see that it is very small (Table 10, p. 81) (U.S Census Bureau, 2010-2014d). Since the labor force in Elk Creek is so small, people from outside will be needed to fill any additional jobs that come available. The labor force of an estimated 240,484 persons in the 50-mile radius is much larger (Table 11, p. 83) (U.S. Census Bureau, 2010-2014e). The unemployment rate is low (5.5%). However, the estimated number of unemployed people is 13,235, which would be enough to fill the mining jobs, as well as those created by the mining jobs. This means that people will be less likely to move to Elk Creek

because the 50-mile radius has more people to take the mining jobs, making it less likely that many people from Elk Creek work at the mine.

Finally, the vacant housing stock in Elk Creek is only 10 dwellings as of the 2010 Census (Table 14, p. 85) (U.S. Census Bureau, 2010a). A housing survey conducted by the author of this thesis indicates that this is probably pretty accurate, as the total number of housing units (53) counted in the survey (Table 13, p. 84), is fairly close to the total number of housing units (57) shown in the 2010 Census (U.S. Census Bureau, 2010a). In the 50-mile radius, there are 16,924 vacant housing units available (Table 15, p. 85) (U.S. Census Bureau, 2010-2014j). This means that people will be more likely to move into the area of the 50-mile radius, where there is housing available, than move to Elk Creek, where housing would need to be built. Therefore, it is very likely that the 50-mile radius would absorb many of the workers that move into the area to take advantage of mining jobs, and others that result from their presence due to the multiplier effect.

This data shows that it is very possible and might be very likely that Elk Creek will not experience a boom. In this case, there would only be a few people moving to Elk Creek on a permanent basis. In this scenario, temporary workers will still be needed for the construction phase. Crew camps would likely be the form of housing used for temporary workers. However, the movement of permanent employees may result in a small boom in the 50-mile radius region as people move to communities in the area that offer more housing and more job and school opportunities for families. Housing added to Elk Creek will be at the discretion of the mining employees and private developers. If they decide to move to the community on an individual basis, they will likely buy a lot in town a build their own traditional housing unit. A private developer could build a few houses as well.

One way for Elk Creek to benefit in this scenario is to work with the other communities in the 50-mile radius to create a comprehensive plan for the region that focuses, in part, on responding to the mine situation. In the plan, each community in the region could outline its goals for community growth. They could aim to encourage a specific amount of growth in each community. Larger communities that have the ability to accommodate for more people could absorb some of the population so that smaller communities, such as Elk Creek are not overwhelmed. In addition, these larger communities could limit their growth in order to help encourage smaller amounts of growth in small communities. This would allow many communities to experience the benefits of growth while protecting smaller communities from the threat of outgrowing their ability to offer services and the additional threat of a bust.

In addition, the plan could include options for encouraging growth in communities near the outer boundaries of the 50-mile radius. One way to do this would be for NioCorp to provide shuttle services using busses to and from work. This would allow people to live further from the mine and still be able to work there. Again, this would help to benefit all communities in the region. In addition to shuttles, NioCorp needs to be involved with the process of housing employees. Ultimately, decisions should be made by the communities affected, but involving NioCorp as a consultant in the process of creating the plan could help the communities to further avoid issues they may not be aware of but NioCorp is. It could also help to foster a relationship between the company and the local people and communities with the possibility of preventing animosity between the entities if things begin to go wrong.

5.5 Scenario Summary

The three scenarios allow us to examine how a community could react to the housing depending upon the circumstances. The most realistic scenario listed here is Scenario 3, in which no boom appears in Elk Creek. The other two scenarios can be used to compare what an extreme boom scenario could look like versus the most likely scenario. A summary of the three scenarios outlined in the above chapters is listed in Table 16 (p. 106-108).

Scenario 1 and Scenario 2 would both see 1,200 temporary construction workers move to Elk Creek and 0 move to the 50-mile radius. However, in Scenario 3, this will depend upon where NioCorp and private developers decide to place the housing. In Scenario 3, unlike in the other scenarios, Elk Creek may not have to deal with housing temporary employees. The potential number of permanent employees in Scenario 1 would be 400 employees in Elk Creek and 0 in the 50-mile radius. In Scenario 2, this number would be 100 in Elk Creek and 300 in the 50-mile radius. In Scenario 3, Elk Creek will only gain residents if mine workers decide to move there on an individual basis. This would likely result in very few people moving to the village. However, the 50-mile radius would likely gain the others, along with those moving to the area due to the multiplier effect. In comparison to the first two, Scenario 3 would need less housing to be built due to the abundance of housing available in the 50-mile radius. Essentially, it is the most likely scenario due to the fact that other communities in the 50-mile radius offer more housing options and opportunities for families than Elk Creek does. The 50-mile radius will absorb the people that decide not to move to Elk Creek. The multiplier effect of people moving to Elk Creek on the 50-mile radius is 5,332 in Scenario 1, 1,333 in Scenario 2 and unknown in Scenario 3. In the third scenario it will depend on the

Table 16 **Summary of Scenarios Outlined in Chapter 5**

	Scenario 1 (Boom Upper Extreme)	Scenario 2 (Boom Lower Extreme)	Scenario 3 (Most Likely Scenario)
Peak Number of Future Temporary Construction Workers in Elk Creek, Nebraska	1,200	1,200	This will depend on where NioCorp and private developers decide to place temporary housing.
Peak Number of Potential Future Permanent Mine Employees in Elk Creek, Nebraska	400	100	Very few. This will be subject to the employees looking to live in the area. If an employee lives in Elk Creek, he or she will do so by choice on an individual basis.
Peak Number of Future Temporary Construction Workers in the 50-mile Radius	0	0	This will depend on where NioCorp and private developers decide to place temporary housing.

Peak Number of Potential Future Permanent Mine Employees in the 50-mile Radius	0	300	This could vary depending on how many people move to the area to take advantage of new jobs. It is possible a small boom could be seen in the region as opposed to Elk Creek, in this scenario.
Multiplier Effect of People Moving to Elk Creek on the 50-mile Radius	5,332	1,333	Unknown. It depends upon the number of people that will move to Elk Creek.
Primary Housing Suggestion for Temporary Construction Workers in Elk Creek	Combination of crew camps and some apartment buildings. The apartment buildings will be filled by permanent employees after the temporary workers leave.	Combination of crew camps and mobile homes. The mobile homes can act similar to crew camps, but possibly as more permanent housing in the future. Additions can be built onto the mobile homes in the future.	Crew camps. They can be removed when the temporary workers are no longer needed. Apartment buildings could be used in larger communities in the 50-mile radius.

Primary Housing Suggestion for Future Permanent Residents in Elk Creek	Apartment buildings. The apartment buildings will be filled by permanent employees after the temporary workers leave.	Mobile homes. Mobile homes can serve as both temporary and permanent structures. They are cheap for families to own, but can be added on to in the future.	Traditional style housing in Elk Creek. In the 50-mile radius, private developers could create traditional style housing or apartment buildings in larger communities.
Bust Scenario	Temporary construction workers and permanent employees leave Elk Creek and leave empty apartment buildings behind.	Temporary construction workers and permanent employees leave Elk Creek. Mobile homes can be removed if they are no longer needed after the bust.	There would be no boom in Elk Creek, so there would be no bust there. In the 50-mile radius, it is possible that if a bust happened at the mine, there would be enough job opportunities in larger communities, such as Lincoln, Nebraska, that many people could possibly stay in the area.

number of people who move to Elk Creek, which is unknown. However, this number is likely to be small.

The housing recommendations differ for each scenario. For temporary construction workers, crew camps are recommended for each scenario. In Scenario 1, incorporating apartment buildings is also recommended. In Scenario 2, mobile homes are also recommended. In Scenario 3, only crew camps are recommended. In the most realistic scenario, the crew camps can be used for the people moving in on a temporary basis, knowing they will not move to the area and assuming that few permanent employees will need housing in Elk Creek.

The housing recommendations for permanent employees in Elk Creek also differ for each scenario. Apartment buildings are recommended in Scenario 1, mobile homes in Scenario 2, and traditional style housing in Scenario 3. They all come with different risks. In Scenario 1, permanent buildings are built to house both temporary and permanent workers. Building permanent housing for temporary workers is risky because it is difficult to know for sure if there will be enough permanent employees to fill those vacant units. In addition, if a bust occurs in the community and people move out, Elk Creek will be stuck with expensive, empty apartment buildings. This, combined with the lack of housing and job opportunities in Elk Creek, is why this is the least likely scenario. In Scenario 2, mobile homes are recommended due to the fact that they are cheap and can serve as both temporary and permanent structures due to their potential longevity. They can also be added onto in the future. However, these homes do require utilities and can be expensive to move, in the event that a bust occurs and empty homes are left in Elk Creek. In Scenario 3, traditional-style housing is the recommended option for permanent workers due to the fact that few people are expected to move to Elk Creek in this

scenario. In the case of a bust, Elk Creek would not be greatly affected if few people moved to the village. The opportunities for jobs in larger communities in the 50-mile radius increase the chances that people may stay in the area in the case of a bust.

Chapter 6: Conclusions

It is important for communities experiencing a potential boom situation to plan ahead and determine what is best for that community. In the case of Elk Creek, Nebraska and the NioCorp mining project, it is likely that the village will not see a great deal of growth. The data available, as well as the desires of NioCorp, indicate that many of the future employees at the mine will come from the 50-mile radius for the approximate center of the mineralization. In addition, there are more housing and job opportunities available for family members in larger communities in the 50-mile radius. Therefore, it is unlikely that Elk Creek will see a great boom in population. This means that the need for additional housing in Elk Creek will not be significantly large. This was not the case in North Dakota, as the oil drilling was completed at multiple locations and housing was needed throughout a large region. In the case of Elk Creek, the mine is in one location and people do not need to live in Elk Creek to be close enough to the mine to work there.

The most beneficial scenario may include Elk Creek adding a few mine workers to the community in order to grow a small amount, while encouraging other industries to move into the area to offer job opportunities for the families of the mine workers and allowing the community to better respond to the needs of its residents. This would allow them to benefit from population growth, but reduce the risk for housing shortages and price and wage spikes which might harm the socioeconomic aspects of the community. This could be accomplished by creating a region-wide plan for the 50-mile radius for dealing with and attracting workers that would be beneficial to the whole region. This would allow communities like Elk Creek to determine their capacity and desire for growth, while relying on other communities in the area to attract some people so that the

smaller communities do not get overwhelmed. This would allow them to benefit from the additional population in the region, while protecting the communities from gaining more development and population growth than they can accommodate. By incorporating NioCorp into the plan development process, the communities can make sure that the company is involved in planning for its employees. The company can help to point out issues that the communities may want to avoid. In addition, the company can begin its own plans to improve employees' lives. One example of this would be to offer shuttle services to employees living further away from the mine. Regardless of the outcome, it is important for Elk Creek to begin examining the potential for growth and cooperate with other communities in the area now so they are not caught unprepared in the future.

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