Will the pipeline operation have an impact on land values?

The governance documents associated with the Keystone XL Pipeline project specify that TransCanada will compensate all landowners for any loss of revenue during the construction phase. Once the pipeline becomes operational, TransCanada is still responsible for any loss of revenue related to repair, monitoring, or pipeline-related activities. This White Paper examines operational impacts in more detail. The impacts of interest are those that might have a negative influence on a property's value. For residential property, the issue is whether the pipeline makes a property less desirable to potential buyers. For agricultural property, the issues are whether the pipeline reduces productivity of land (which is the basis for the selling price) or if the pipeline creates a corridor for the expansion of invasive species.

When current landowners sell a permanent fifty-foot easement to TransCanada, they are accepting the future limitations on development possibilities that are now attached to that right of way. That strip is no longer available for future structures, irrigation wells, or trees. The easement allows normal farming and grazing operations to continue in the right of way. While the easement limits future development opportunities, the landowner has received appropriate compensation; therefore, there is no economic negative externality. All property purchase decisions consider a wide bundle of existing property rights and characteristics. The pipeline is not considered in isolation.

Pipeline basic information

The Keystone XL project is a proposed 875-mile pipeline allowing the movement of crude oil from the Western Canadian Sedimentary Basin and the Bakken Shale Formation to refineries along the Gulf Coast. The Nebraska portion of the 36 inch diameter pipe is generally buried 48 inches below surface and operates at a maximum pressure of 1,308 pounds per square inch. The pipeline allows movement of up to 830,000 barrels per day. As the diluted bitumen slurry moves through the pipeline, friction generates considerable heat. Chemical dilutants are added to the slurry to improve its viscosity, but no additional heat is introduced. Under normal operation, the pipeline has a temperature ranging between 90°F and 130°F. This varies by time of year, with the hottest pipeline temperatures occurring in summer. Dispersed heat from the pipeline enters the surrounding soil, thus raising the soil temperature 4°F to 8°F at the surface and 10°F to 15°F at 6 inches below the surface. According to the Nebraska Department of Environmental Quality, soil temperature close to the pipeline could be as much as 40°F warmer than ambient soil temperature.

The initial route proposed by TransCanada drew considerable opposition because of concerns regarding possible ground water contamination in the event of a spill. After considering several alternative routes, the Nebraska Preferred Route was selected to avoid the Sandhills region. This route enters Nebraska in Keya Paha County, runs diagonally to the southeast to Antelope County, runs south to Nance County, then turns southeast to the intersection with the existing Keystone Pipeline in Jefferson County. The 275.2 mile Nebraska segment of the pipeline runs mostly through cultivated crop land and grassland. The following table presents the land use types along the selected route.

Land Use	Miles	Percent
Cultivated Crops	180.9	65.73%
Grassland/Herbaceous	78.3	28.45%
Developed, Open Space	8.4	3.05%
Pasture/Hay	2.1	0.76%
Deciduous Forest	1.9	0.69%
Woody Wetlands	1.7	0.62%
Open Water	0.7	0.25%
Emergent Herbaceous Wetlands	0.7	0.25%
Developed, Low Intensity	0.3	0.11%
Mixed Forest	0.1	0.04%
Other	0.1	0.04%
Total	275.2	100.00%

Source: TransCanada Keystone Pipeline Application for Route Approval

Pipeline impact on residential value

In the Nebraska segment of the Keystone XL Pipeline, there are no existing residential structures in the fifty-foot right of way and only twenty-two homes within 500 feet of the pipeline. The construction phase may create a temporary dust or noise annoyance for the occupants of those twenty-two homes.

Economists use a technique known as Hedonic Modeling to evaluate the price impact of amenities or risk associated with location. For example, two houses may be identical in every way except location. A house located on a pristine lake will have a higher price than the exact same house located in a typical suburb. Hedonic Modeling can identify either positive or negative influences. A house located downwind from a hog confinement facility will sell for a lower price than one in a typical suburb. The difference in price thus creates a market derived valuation of that particular amenity or negative externality.

Most studies of pipeline impact have focused on changes in property values after an accident or explosion. A frequently cited study looked at the property value impact of a gasoline pipeline explosion in Bellingham, Washington in 1999. Bellingham had two major pipelines going through the city. Immediately following the explosion of the Olympic pipeline, which killed three people, property values declined by approximately 4.6% within 50 feet of the pipeline that had suffered the rupture. This effect was influenced by distance, falling to 2.3% decrease at a distance of 100 feet, 1.2% at 200 feet, and 0.2% at 1,000 feet. Additionally, this negative property value impact decreased with the passage of time. This was a significant research effort with the hedonic modeling exercise involving a pre-event sample size of 1,753 individual home sales and a post-event sample of 2,012 sales.
Hedonic Modeling of the 5 ½ year time period prior to the explosion found no evidence that either of the two pipelines had an effect on local property values. Even after the explosion and all the resulting media coverage, the researchers found that the second pipeline had no effect on nearby property values.

These results are not unexpected. Property values are negatively impacted by odors, unsightly landscapes, health and safety risks, and persistent loud noises. Installed pipelines are literally out-of-

sight and out-of-mind for ordinary landowners. The Bellingham study cited a State of Washington survey gauging public awareness of pipeline location. That study found that 55% of the homeowners living near a pipeline "flatly denied" that they lived anywhere near a major pipeline.

The completed Keystone Pipeline Phase 1 in Nebraska gives us immediate information on the potential impact of a pipeline on property values. On June 13, we talked directly with the county assessors from Butler County (Vickie Donoghue) and Saline County (Brandi Kelly). Both assessors stated without hesitation that the existing pipeline had no impact on land values. There was no land value adjustment on the property bisected by the pipeline and no adjustment on adjacent property. Additional researcher conversations with realtors and landowners also indicated no meaningful impact on land values in the pipeline right of way.

In October 2014, the Federal Energy Regulatory Commission issued its final report on the proposed Constitution Pipeline in New York. That report found no evidence for a systemic drop in property values. A February 2016 report issued by the Interstate Natural Gas Association of America examined the possible effect of a natural gas pipeline on property values in four different cities. The report concluded that the presence of the pipeline does not affect the value of the surrounding property, its insurability, or the ability of a homeowner to obtain a mortgage.

Notwithstanding any of the previous comments, there could certainly be individual circumstances where the presence of the pipeline may make a particular piece of property less desirable to some group of potential buyers. Given the rural landscape for the Keystone XL Pipeline, the limitations of future residential development are miniscule.

In our professional judgement, the ordinary operation of the pipeline will have no impact on residential property value. During the construction phase, landowners are compensated for easements or crop damage. In the event of an accident or pipeline rupture, the pipeline operator is responsible for mitigation, cleanup and restoration. It is possible that in the event of a major oil spill from the pipeline, surrounding property values would likely decline for several years. The economic impact of a spill on land values cannot be accurately modeled because the rarity of significant spills makes each spill a unique event.

Pipeline impact on agricultural values

The US Department of State Final Supplemental Environmental Impact Statement (January 2014) lists TransCanada's obligations to agricultural producers stemming from the construction and operation of the pipeline. As specified, TransCanada's obligations do not end at the completion of the construction period. Any future decrease in crop yield caused by operation of the pipeline would require compensation.

> Agricultural Land, Rangeland, and Prime Farmland Disturbed agricultural land and rangeland would be returned to approximate pre-construction use and capability. For agricultural land and rangeland requiring reseeding, an inspection after the first growing season would determine if additional revegetation would be required. Keystone would work with the landowner regarding the type of vegetation that would be re-established when tilled fields are disturbed. If the landowner performs the required reseeding, monetary compensation would be provided. Revegetation would be considered successful when crop yields or vegetation are similar to those in adjacent undisturbed portions of the same field. Landowners would be compensated—as specified in Appendix R, Construction/Reclamation Plans and Documentation—for crop yields less than those on unaffected lands where it could be demonstrated that the lesser yields are a result of the proposed Project. For the purpose of determining compensation for lesser yields, crop values would be assessed based upon the values of the affected crops in the specific area, as well as local crop prices at grain elevators. Landowners would be compensated for proposed Project-related crop yield effects over 3 years as follows: during the year of construction, 100 percent of calculated losses would be compensated; in the second year, 75 percent of calculated losses would be compensated; in the third year, 50 percent of calculated losses would be compensated. If landowners demonstrate that proposed Project-related crop yield losses persist beyond 3 years, additional compensation would be negotiated.
> Should CRP participants be required by the USDA to leave the CRP because of the proposed Project, they would be compensated by Keystone. Compensation would be for any lost CRP payments, including retroactive forfeit payments. (Final Supplemental Environmental Impact Statement for the Keystone XL Project, January 2014, DOS Section 4.9 page 14)

The selling price of agricultural land is directly tied to the productivity of that land. The basic question then is whether the elevated soil temperature from the pipeline operation will have a meaningful impact on pasture growth or crop development. There are no existing published academic studies that directly evaluate the impact of pipeline heat on agricultural production.

However, there are studies that examined the influence of elevated soil temperatures on seed germination, plant development, and total biomass. These generic studies of warmer soil generally find that the greatest impact occurs in early spring because the warmer soil encourages faster seed germination. The minimum soil temperature for corn seed germination is 55°F and for soybean seed is 59°F. In Nebraska, these important soil temperatures are typically reached in early May along the pipeline route, of course with a south to north orientation.

The TransCanada Pipeline Application includes the following table.

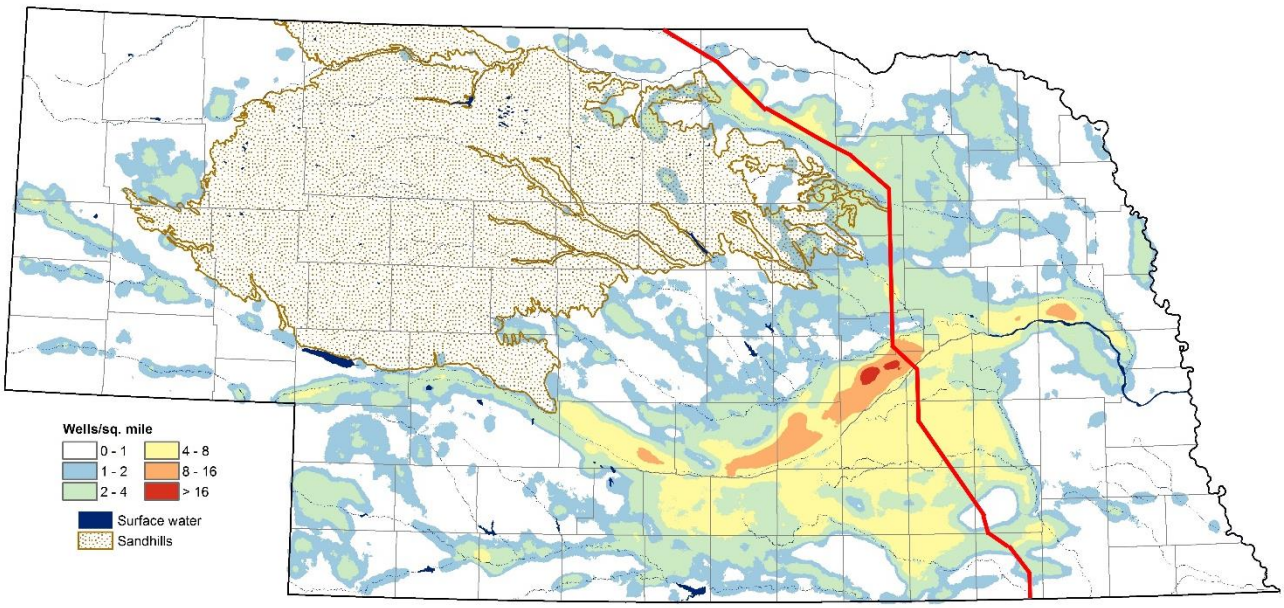
Effects of Elevated Soil Temperature on Typical Vegetation Crossed by the Keystone XL Pipeline

Vegetation/Crop Type and Experimental Soil Temperature Range	Enhanced Growth Effects	Negative Growth Effects
Big bluestem: Tall-grass prairie species (44°F to 95°F)[a]	• Earlier germination and emergence. • Faster growth rate. • Higher net photosynthesis. • Greater total biomass. • Strong growth dependence on soil temperature	• No negative effects reported although optimum soil temperatures for greatest biomass production were 77°F.
Various wetland species (41°F to 86°F) [b]	• Stem density increased with increasing soil temperature. • Total and annual species richness positively correlated with temperature.	• None reported although perennial species richness was unresponsive to temperature increases.
Spring Wheat (60°F to 105°F)[c]	• Occasional higher soil moisture. • Occasional higher crop yield.	• None reported.
Corn (50°F to 105°F)	• Warmer early-season soil temperatures hasten plant emergence and development. [d] • Optimum germination occurs at soil temperatures of 85°F. [e] • Yield increases with higher soil temperatures at planting (75°F to 85°F).[f] • Soil temperatures late in summer less important than air temperature.[f]	• None reported. Effect of high soil temperatures in late summer secondary to effects of high air temperature, low soil moisture, and corresponding drought. [f]
Soybeans (50°F to 109°F)	• Optimum soil temperatures for germination is 82°F.[i] • Soybean has competitive advantage over weeds when soil temperatures promote soybean germination. [j]	• None reported. Similar to corn, effect of high soil temperatures in late summer secondary to high air temperature, low soil moisture, and corresponding drought. [j]

a (Delucia et al. 1992); b (Seabloom 1998); c (Dunn et al. pre-published draft); d (Bollero 1996); e (Parsons 2001); f (Riley 1957); i (Tyagi and Tripathi 1983); j (Berglund a Helms 2003).

In addition to the warmer soils leading to earlier germination, the heat from the pipeline may also create drier soils. This could be particularly problematic if the drier soils are occurring in the root zone for commercial crops. Mature corn roots can reach a depth of 8 feet, but the majority of the roots are in the 4-foot range. Most soybean roots form in the upper 12 inches of soil, though they can extend 4 to 8 feet deep. The possible impact of drier soils created by the pipeline is largely mitigated by the existing extensive use of irrigation. The Keystone XL Pipeline passes through an area that already features considerable irrigation infrastructure. The following map illustrates the density of irrigation wells (pipeline overlay by authors).

Density of Active Registered Irrigation Wells - December 2016



CONSERVATION AND SURVEY DIVISION (http://snr.unl.edu/csd)
School of Natural Resources (http://snr.unl.edu)
Institute of Agriculture and Natural Resources
University of Nebraska-Lincoln

Aaron Young, Survey Geologist, CSD
Mark Burbach, Water Levels Program Supervisor, CSD
Les Howard, GIS Manager, CSD
Michele Waszgis, Research Technician, CSD

Source:
Nebraska Department of Natural Resources

CONSERVATION AND SURVEY DIVISION
School of Natural Resources

The University of Nebraska–Lincoln does not discriminate based on gender, age, disability, race, color, religion, marital status, veteran's status, national or ethnic origin, or sexual orientation.

December 2016

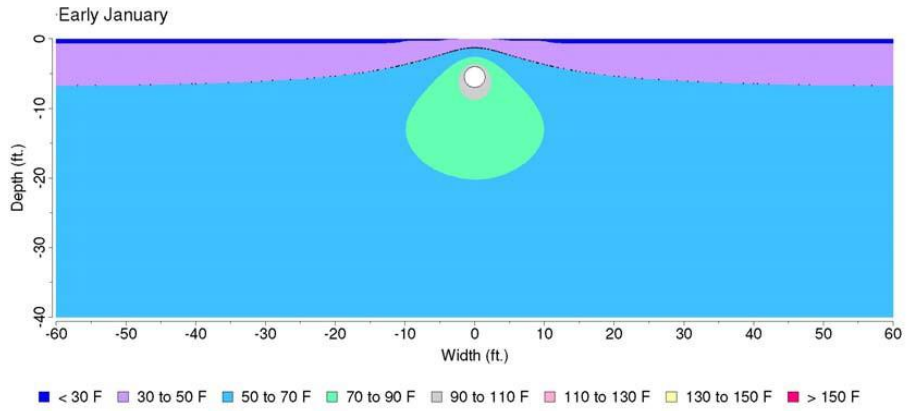
Disclaimer: groundwater-level changes on this map are depicted at a small scale. They are intended to provide only a general overview of regional variation.

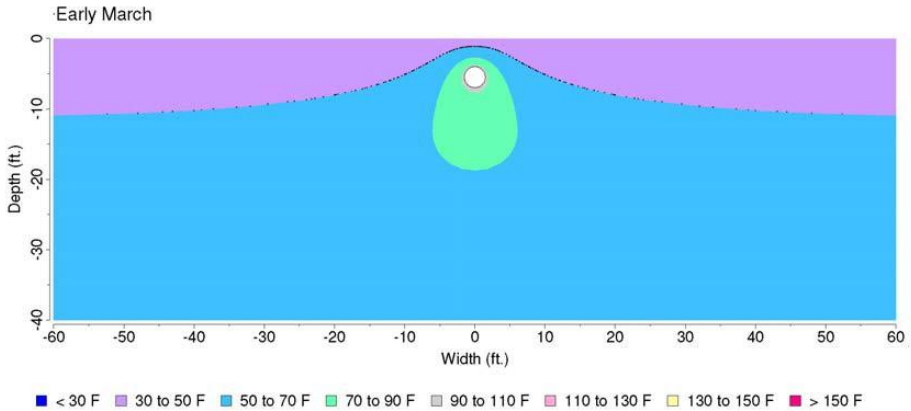
Invasive Species

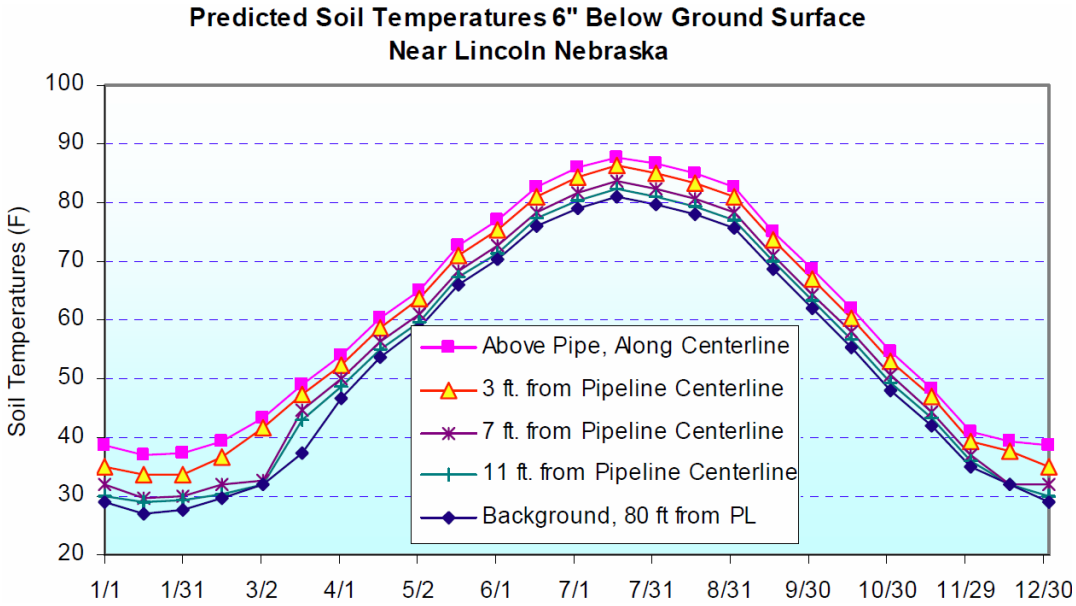
Invasive species are plants or animals that enter an environment where they are not native and become a nuisance through the rapid spread and increase in numbers. The invaders often out compete native species. Because invasive species tend to move south to north, freezing soil temperature presents a natural barrier to the spread of many unwanted plants or insects. Landscape biologists or ecologists tend to think of corridors and blocks as the basic structure of a local environment. A frost-free corridor running north and south could increase the penetration of invasive species.

According to a study included in the US Department of State Environmental Impact Study for Keystone XL, the soil directly above the pipeline may never freeze in Nebraska. The average depth of frost is approximately 5 feet below ground surface in the northern portion of the proposed Nebraska Reroute and 4 feet below ground surface in the southern portion (National Oceanic and Atmospheric Administration, 1978). The DOS document illustrates the pipeline heat impact in two ways, through a temperature diagram showing the temperature gradient and through a graph showing temperatures at different times of the year.

The existing ground temperature studies do not match the exact pipeline route, however, the existing results for readings taken near Lincoln will serve as a useful guide. The pipeline heat is sufficient to prevent surface soil freezing in January. The March diagram indicates that all the soil is frost-free at the surface.

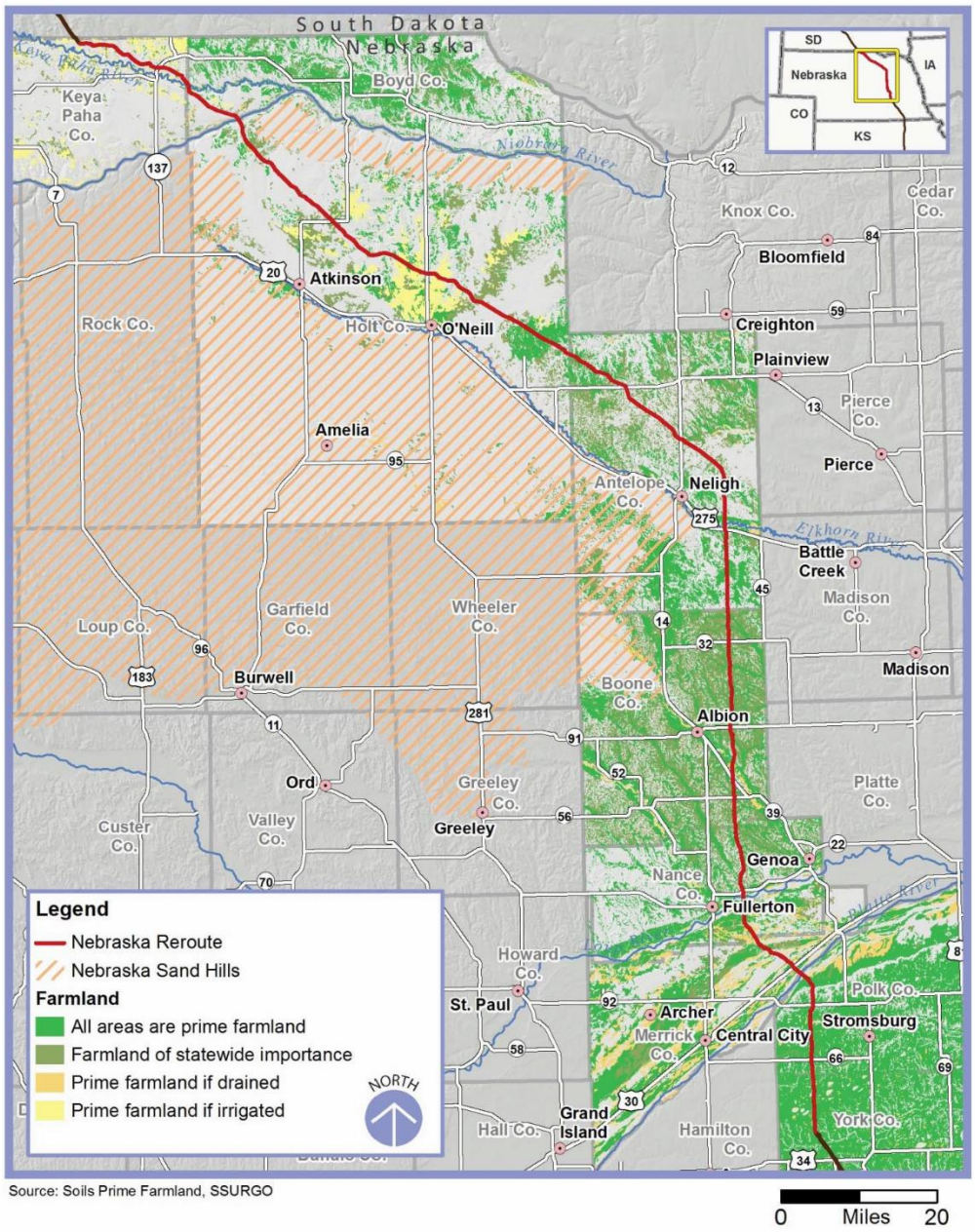






Current farming practices will likely mitigate the possibility of creating an invasion corridor. The southern half of the Nebraska portion of the pipeline runs almost exclusively through prime farmland. This land is cultivated each year for crops. Part of the normal agricultural process for this prime farmland would include some combination of tillage, planting, cultivation, pesticide application, and insecticide application. Each of these normal farming practices would disrupt this invasive corridor, thus mitigating the potential of invasive species using the pipeline heat as a mechanism for moving north more rapidly than what would otherwise occur. The following map shows this prime farmland region which will serve as a barrier to invasive species.

Figure 4.10-1. Prime Farmland along the Proposed Nebraska Reroute



Pump station impact on agricultural values

The five pump stations constructed as part of the Keystone XL project may potentially impact the value of surrounding property. The pump stations will not prevent normal agricultural operations from occurring, but they may limit future low-density residential development of nearby acres. Urban "sprawl" has a rural counterpart. Many families, wanting to have horses or to experience a more rural lifestyle, are moving out of small rural cities into low-density residential developments with each lot ranging from one to ten acres. This low-density development is driven by the attributes associated with residential amenities. The landowners want a scenic view, little noise, and a safe environment. At the very least, a majority of families would not move to an out of town acreage adjoining or visually influenced by an operating pump station. Thus, the characteristics of the pump station will diminish the development potential of nearby agricultural property. Given the route of the proposed pipeline through very rural areas, this potential economic negative externality may actually prove to be minimal.

Keystone Phase 1 Pumping Station west of Wilber, NE

Limitations on future land development

The evidence indicates little pipeline influence on property market value; however, there are individual circumstances where the easement restrictions limit the development potential of an entire tract. While the easement limitations have no effect on normal agricultural operations, they may render an entire

piece of property less desirable for future development. For example, a landowner may be unable to sell an entire piece of property to a commercial developer because the easement limits future buildings on the right of way. In 2014, a North Texas family won a $2.1 million verdict against a pipeline company after their parcel of land lost value because an easement was taken for a gas line (Peregrine Pipeline Co., L.P. v. Eagle Ford Land Partners). The pipeline company has appealed the original verdict, so the eventual outcome is not yet known. Over the fifty-year life expectancy of the pipeline, it is impossible to predict whether this situation of limiting commercial development will occur along the Keystone XL segment in Nebraska.

Conclusion

According to the US Department of Transportation, there were 56,373 miles of crude oil pipeline in the US in 2014. As illustrated by the following map, these lines lay beneath both urban and rural areas. If these crude oil pipelines had substantial influences on property values, agricultural production, invasive species, or land development potential, one would expect a plethora of academic studies examining the issue in detail. Property owner complaints would be commonplace if the pipeline proved to be an actual barrier to the quiet enjoyment of their property. Additionally, one would anticipate a substantial amount of litigation attempting to compensate landowners for any negative consequences associated with the pipeline.

Lacking any of these indicators of meaningful influence, we conclude that pipelines play an insignificant role in residential value, crop production, invasive species, and land development.

Map of US Crude Oil Pipelines