SMR SITING TECHNICAL SCREENING STUDY: PHASE 1

SUBMITTED TO
NEBRASKA PUBLIC POWER DISTRICT

SITING STUDY
PROJECT NO. 151027

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FOREWORD

BY NEBRASKA PUBLIC POWER DISTRICT

Background

The Nuclear Plant Siting Feasibility Study Program is an authorized use of funding from SLFRF (Assistance Listing 21.027) which was designed to provide state governments with the resources needed to respond to the COVID-19 pandemic and its economic effects and to build a stronger, economy during recovery. SLFRF was established by ARPA signed into law by the President of the United States on March 11, 2021.[3]

SMR deployment to replace retiring electricity generation assets and meet growing generating needs would result in significant growth in domestic manufacturing, tax base, and high-paying factory, construction, and operating jobs. A 2010[1] study on economic and employment impacts of SMR deployment estimated that a prototypical 100 MWe SMR costing $500 million to manufacture and install would create nearly 7,000 jobs and generate $1.3 billion in sales, $404 million in earnings (payroll), and $35 million in indirect business taxes.[2]

Nuclear Energy in the U.S. Today[4]

In 2023, nuclear energy provided almost 19% of U.S. utility-scale electricity generation and nuclear energy accounted for about 47% of carbon-free U.S. utility-scale electricity generated in 2023[4-1]. Across the U.S., there are 94 nuclear power reactors licensed by the U.S. Nuclear Regulatory Commission, including one in Nebraska providing over 28% of the state's electricity[4-2]. The U.S. nuclear power fleet has operated at greater than 90% of installed capacity since 1999 and, globally, nuclear power is among the safest ways to generate electricity[4-3]. This is thanks, in part, to the strong nuclear safety culture held by the U.S. nuclear fleet – a commitment to safety first and foremost — for the protection of people and the environment. Other foundational principles of the U.S. nuclear industry include sharing lessons learned and striving for continuous improvement.

In Section 47 of LB1014, an amount of **$1,000,000** was appropriated to the Nebraska Department of Economic Development (DED) in grants pursuant to the purposes of conducting a feasibility study to assess (1) siting options for new advanced nuclear reactors throughout Nebraska and (2) existing electric generation facilities based on key compatibility assets for such advanced nuclear reactors.[3]

Additionally building on this support for new nuclear in the State of Nebraska, LB 565 was signed into law in 2023 to establish a state level Nuclear and **Hydrogen Industry Work Group**. The work group shall examine and make recommendations to DED regarding the workforce training needs of the nuclear and hydrogen industries and provide an opportunity for collaboration of such industries with the Nebraska community college system and Nebraska state college system to develop education training courses.

Benefits of Small Modular Reactors

A new breed of small modular reactors (SMRs) is being developed. SMRs provide simplicity of design, enhanced safety features, the economics and quality afforded by factory production, and more flexibility (financing, siting, sizing, and end-use applications) compared to larger nuclear power plants. Additional modules can be added incrementally as demand for energy increases.[2]

SMR designs have the distinct advantage of factoring in current safeguards and security requirements. Facility protection systems, including barriers that can withstand design basis aircraft crash scenarios and other specific threats, are part of the engineering process being applied to new SMR design. SMRs additionally benefit from the experience of the existing fleet and have the opportunity to incorporate learnings from the outset of their design and throughout the engineering process. SMRs also provide safety and potential nonproliferation benefits to the United States and the wider international community. Most SMRs will be built below grade for safety and security enhancements, addressing vulnerabilities to both sabotage and natural phenomena hazard scenarios. Some SMRs will be designed to operate for extended periods without refueling. These SMRs could be fabricated and fueled in a factory, sealed, and transported to sites for power generation or process heat, and then returned to the factory for defueling at the end of the life cycle. This approach could help to minimize the transportation and handling of nuclear material. Light water-based SMRs are expected to be fueled with low enriched uranium, i.e., approximately 5 percent U-235, similar to existing large nuclear power plants. The "security by design" concepts being applied to these technologies are expected to increase SMR resistance to theft and diversion of nuclear material. Also, reactor cores for these light water SMRs can be designed to burn plutonium as a mixed oxide (MOX) fuel. Further, SMRs based on non-light water reactor coolants could be more effective at dispositioning plutonium while minimizing the wastes requiring disposal.[2]

The term "modular" in the context of SMRs refers to the ability to fabricate major components of the nuclear steam supply system in a factory environment and ship to the point of use. Even though current large nuclear power plants incorporate factory-fabricated components (or modules) into their designs, a substantial amount of field work is still required to assemble components into an operational power plant. SMRs are envisioned to require limited on-site preparation and substantially reduce the lengthy construction times that are typical of the larger units.[1]

SMRs can provide power for applications where large plants are not needed or sites lack the infrastructure to support a large unit. This would include smaller electrical markets, isolated areas, smaller grids, sites with limited water and acreage, or unique industrial applications. SMRs are expected to be attractive options for the replacement or repowering of aging/retiring fossil plants, or to provide an option for complementing existing industrial processes or power plants with an energy source that does not emit greenhouse gases.[2]

SMR deployment to replace retiring electricity generation assets and meet growing generating needs would result in significant growth in domestic manufacturing, tax base, and high-paying factory, construction, and operating jobs. A 2010[1] study on economic and employment impacts of SMR deployment estimated that a prototypical 100 MWe SMR costing $500 million to manufacture and install would create nearly 7,000 jobs and generate $1.3 billion in sales.[2]

History of Nuclear in Nebraska

Nebraska has a long history of utilizing nuclear technology in the state. In the 1960's, one of the first test reactors coming out of the "Atoms for Peace" initiative was located at NPPD's Sheldon Station in Hallam, NE. Additionally, during this era, a nuclear isotope reactor was placed in the basement of the Omaha Veteran's Administrative hospital which emerged as one of the key national centers of radioisotope research and diagnosis. In the early 1970's NPPD and OPPD constructed and placed into operation two commercial power plants: one at Cooper Nuclear Station located in Brownville NE and the other at Fort Calhoun Station located in Fort Calhoun NE.

This Siting report establishes a new baseline for the 21st Century that Nebraskans can look to the future for use of these new technologies in the nuclear industry with the Small Modular Reactors (SMRs).

[1] Economic and Employment Impacts of Small Modular Reactors, June 2010, Energy Policy Institute of the Center for Advanced Energy Studies
[2] DOE Benefits of SMRs Website (Benefits of Small Modular Reactors (SMRs) | Department of Energy)
[3] Nuclear Plant Siting Feasibility Study Program Manual, State of Nebraska, October 2022 | 1.1; Section 2 Program Overview
[4] See references from NEI listed below:
  [4-1] https://www.eia.gov/tools/faqs/faq.php?id=427&t=21 [eia.gov]
  [4-2] https://www.nei.org/CorporateSite/media/filefolder/resources/fact-sheets/state-fact-sheets/Nebraska-State-Fact-Sheet.pdf [nei.org]
  [4-3] https://ourworldindata.org/safest-sources-of-energy [ourworldindata.org]

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EXECUTIVE SUMMARY

This section presents an executive summary of the Phase 1 Small Modular Reactor (“SMR”) Siting Technical Screening Study (“Study”). This Study was completed by a combined project team consisting of 1898 & Co., a part of Burns & McDonnell Engineering Company, Inc. (“1898 & Co.”) and Nebraska Public Power District (“NPPD”) with support from the Nebraska Department of Economic Development (“NE DED”) (“the Project Team”). The objectives, methodology, and results of Phase 1 of this Study are described in the following sections.

Study Objectives and Methodology

The Project Team conducted the Study to determine potential suitable locations for the development of an SMR generation facility (“Project”).

This Study investigated suitable locations within Nebraska and was completed in three steps:

1
Identify applicable exclusionary and avoidance areas for siting an SMR facility utilizing Nuclear Regulatory Commission (“NRC”) regulations and Electric Power Research Institute (“EPRI”) guidelines.

2
Identify candidate communities for detailed evaluation using desktop research and geographic information system (“GIS”) software.

3
Evaluate each candidate community in detail using a quantitative scoring process to identify the communities with the most potential to support the Project.

Identification of Exclusionary/Avoidance Zones

The first step in the community selection process was the identification of exclusionary and avoidance zones based on guidance from the NRC regulations and the EPRI Nuclear Siting Guide. Exclusionary and avoidance zones are defined and enforced for two general purposes. The first exclusionary and avoidance zones purpose is to protect the proposed nuclear facility from external hazards. The second purpose is to protect identified zones from any potential radiation-related effects in the event of radiation release by the proposed nuclear facility.

The Project Team identified the following areas which were marked as exclusionary or for avoidance:

- Population centers (greater than 25,000 residents).
- Radionuclide pathways, including pathways through agriculture, surface water, and air.
- Seismic and geological considerations.
- Extreme weather conditions.
- Hazardous facilities/ hazardous land uses, including ethanol plants, Department of Defense (“DoD”) grounds, airports, and major transportation routes.

Selection of Candidate Communities

Candidate communities were identified based on the following:

- The community contained an existing power generation facility in Nebraska,
- Request from Nebraska Stakeholders was received to evaluate the community (municipal entity, NPPD, Omaha Public Power District ("OPPD"), etc.), or
- A review of critical infrastructure and exclusionary and avoidance zones identified the community as potentially suitable for an SMR site.

The Project Team then reviewed aerial photography and GIS databases for potential communities to identify a potential candidate community that would be representative of the area. GIS databases and software utilized as part of this Study include Google Earth, ArcGIS Online, National Wetlands Inventory ("NWI") Mapper, United States Fish & Wildlife Service ("USFWS") IPaC tool, Environmental Protection Agency ("EPA") environmental justice ("EJ") Screen Tool, the Homeland Infrastructure Foundation-Level Data ("HIFLD"), and ABB's EVO Data. Each of these GIS databases included visualized information concerning wetlands, floodplains, environmental justice, archaeological and cultural resources, population, Class 1 Areas, and electric transmission infrastructure. The identified communities were then grouped into six specified regions of the state, including the Omaha metro, northeastern, southeastern, northcentral, southcentral, and western panhandle regions of Nebraska. In total, **32 candidate communities were selected** for review across the six regions of the state, with each region being represented by at least three local communities. The candidate communities carried forward for detailed analysis are listed below in **Table 1-1**.

Table 1-1: Selected Candidate Communities

Community	County
Western Panhandle Region	
Lyman	Scotts Bluff
Crawford	Dawes
Rushville	Sheridan
Northeastern Region	
Grand Island	Hall
Genoa	Nance
Norfolk	Madison
Spencer	Boyd
Emerson	Dakota
Southeastern Region	
Hallam	Lancaster
Hastings	Adams
Beatrice	Gage
Wahoo	Saunders
Northcentral Region	
Valentine	Cherry
Ainsworth	Brown
Thedford	Thomas
Broken Bow	Custer

Community	County
Southeastern Region	
Hallam	Lancaster
Hastings	Adams
Beatrice	Gage
Wahoo	Saunders
Southcentral Region	
Sutherland	Lincoln
Lexington	Gosper
Wauneta	Chase
Holdrege	Phelps
Stamford	Furnas
Kearney	Buffalo
Omaha Metro Region	
Nebraska City	Otoe
Plattsmouth	Cass
Bennington	Douglas
Blair	Washington
Springfield	Sarpy
Fremont	Dodge
Brownville	Nemaha
Humboldt	Richardson
Falls City	Richardson
Omaha*	Douglas

*This site was initially considered as part of the study due to grant requirements involving existing generation facilities. This site is not being considered for future study phases at this time.

Candidate Community Evaluation

Once candidate communities were identified, a quantitative decision matrix was used to evaluate and rank each community. In total, 20 different criteria were used to evaluate the candidate communities. These criteria were first organized into six major categories, and these major categories were allocated weights that reflect the importance to the project. Within each major category, the criteria were assigned sub-weights indicative of each criterion's relative importance. The composite weight for each individual criterion was then calculated as an aggregate of all sub-weighted criteria within a major category. The evaluation categories, category weights, criteria, criteria sub-weights, and composite weights are summarized in **Table 1-2**.

Table 1-2: Candidate Community Evaluation Criteria & Weighting

	Criterion	Criterion Weight	Composite Weight
25%	**Electrical Transmission**		
	Transmission System Congestion	40.0%	10.0%
	Distance to Transmission Interconnect	60.0%	15.0%
7%	**Clean Water Supply**		
	Improve Water Quality	100.0%	7.0%
15%	**Health & Safety**		
	Distance to Population Center	50.0%	7.5%
	Downstream Water Usage	25.0%	3.8%
	Hazardous Facilities	25.0%	3.8%
25%	**Site Development**		
	Accessibility	15.0%	3.8%
	Constructability	25.0%	6.3%
	Usable Site Area	20.0%	5.0%
	Water Availability	25.0%	6.3%
	Workforce Availability	15.0%	3.8%
18%	**Environmental**		
	Nearest Noise Receptor	10.0%	1.8%
	Environmental Justice	20.0%	3.6%
	Wetlands	25.0%	4.5%
	Floodplains	25.0%	4.5%
	Archaeological & Cultural Resource Risk	10.0%	1.8%
	Sensitive Species Risk	10.0%	1.8%
10%	**Permitting**		
	Land Use & Zoning	50.0%	5.0%
	Class 1 Areas	50.0%	5.0%

he individual scores for each criterion were used along with the corresponding criterion weights to calculate a weighted composite score for each community. These composite scores are calculated as the sum of the products of each individual score and criterion weight. The base composite evaluation scores range from a low of 30.38 for the Falls City community to a high of 46.38 for the Beatrice community. The average and median scores are 37.81 and 37.30, respectively. **Table 1-3** displays the weighted scores for the top candidate communities.

Table 1-3: Top Candidate Communities Major Category Weighted Scores

Rank	Community	Composite Score	Electric Transmission Score	Clean Water Supply Score	Health & Safety Score	Site Develop-ment Score	Environmen-tal Score	Permitting Score
Major Category Weight ▶		100%	25%	7%	15%	25%	18%	10%
1	Beatrice	46.38	12.50	2.10	6.75	11.75	8.28	5.00
2	Hallam	44.57	12.50	0.70	7.50	11.13	7.74	5.00
3	Sutherland	44.20	12.50	0.70	4.50	12.50	9.00	5.00
4	Hastings	43.09	12.50	0.70	3.75	12.50	8.64	5.00
5	Brownville	42.09	12.50	3.50	5.25	11.88	3.96	5.00
6	Nebraska City	41.78	12.50	0.70	4.50	11.88	7.20	5.00
7	Valentine	40.12	10.50	0.70	7.50	9.50	7.92	4.00
8	Kearney	39.37	10.50	0.70	4.50	11.75	7.92	4.00
9	Fremont	39.36	12.50	0.70	3.00	9.88	8.28	5.00
10	Grand Island	39.32	12.50	0.70	1.50	11.88	7.74	5.00
11	Lexington	39.11	12.50	0.70	4.50	9.13	8.28	4.00
12	Plattsmouth	38.58	12.50	2.10	3.00	10.50	6.48	4.00
13	Wauneta	38.48	8.50	3.50	7.50	8.50	6.48	4.00
14	Holdrege	37.76	8.50	0.70	6.75	10.25	7.56	4.00
15	Rushville	37.45	8.50	3.50	6.75	8.50	7.20	3.00
16	Omaha*	37.44	12.50	0.70	1.50	10.00	7.74	5.00
17	Norfolk	37.15	10.50	0.70	4.50	10.25	7.20	4.00

*This site was initially considered as part of the study due to grant requirements involving existing generation facilities. This site is not being considered for future study phases at this time.

Table 1-3 shows that the top composite evaluation scores range from a low of 37.15 for the Norfolk community and a high of 46.38 for the Beatrice community. The average and median scores of the top communities selected for further evaluation are 40.37 and 39.36, respectively.

Conclusions

As part of the site selection process, 1898 & Co. proposed a three-phase plan to identify, prioritize, and evaluate potential candidate communities for new SMR generation. This Report covers the first phase of the effort to identify top potential candidate communities from each of the six regions of the state of Nebraska to carry into Phase 2. The conclusions reached from this Study are presented below.

The following sites represent the top communities based on the quantitative scoring matrix. NPPD should review to determine sites to proceed with into Phase 2 (ranked from highest to lowest). Communities with asterisks have existing power generation in the area.

1	Beatrice*	2	Hallam*	3	Sutherland*	4	Hastings*	5	Brownville*
6	Nebraska City*	7	Valentine	8	Kearney	9	Fremont*	10	Grand Island*
11	Lexington*	12	Plattsmouth*	13	Wauneta	14	Holdrege	15	Rushville
16	Omaha**	17	Norfolk						

**This site was initially considered as part of the study due to grant requirements involving existing generation facilities. This site is not being considered for future study phases at this time.

When identifying candidate communities, exclusionary/avoidance zones were generally avoided. However, several communities with existing generation sites were evaluated despite being located in an exclusionary/avoidance zone, including Omaha, Grand Island, Plattsmouth, Fremont, Sutherland, Hastings, Nebraska City, and Lexington. Existing generation sites offer significant benefits such as transmission access, water availability, and carbon emissions reductions that warrant further consideration. Since several of these communities with existing generation sites scored among the top potential communities, these communities should be further assessed in Phase 2.

1898 & Co. recommends NPPD conduct further due diligence on the top communities which includes:

- Meet with each of the top candidate communities to engage community discussion and receive valuable feedback in an effort to assess community support and build community relationships.
- Determine representative site parcels and begin further property due diligence.
- Performing site reconnaissance in Phase 2 of this Study to confirm the findings of the desktop review performed in this report.
- Perform a transmission interconnection study at each of the sites in Phase 2 of this Study to identify any issues associated with interconnection constraints.
- Perform detailed site evaluations in Phase 3, including boundary and topography surveys, an ESA, an environmental critical issues assessment, and geotechnical borings.

INTRODUCTION

1898 & Co. was retained by NPPD to perform a Study to evaluate the potential development and construction of a new SMR facility in Nebraska. This introduction presents a discussion of the overall project background and an overview of the methodology for **Phase 1** of the Study.

Background

The Nuclear Plant Siting Feasibility Study Program was authorized, in conjunction with the NE DED, to provide a grant to evaluate clean energy resources to improve water, sewer, and/or broadband infrastructure while reducing greenhouse gas (“GHG”) emissions across the state. NPPD retained 1898 & Co. to investigate a potential SMR facility to provide clean energy to the state of Nebraska.

Study Methodology

The objective of Phase 1 of the Study was to identify potential communities that would be capable of supporting development of a new SMR facility. The Project Team restricted the evaluation to communities that are located within the state of Nebraska.

The community identification and selection efforts were completed in three phases. A brief description of these phases of the desktop review is included below.

1

Exclusionary areas were identified in accordance with NRC regulations and the EPRI Nuclear Siting Guide to eliminate unsuitable siting areas from the screening process.

2

Preliminary communities were identified with consideration of nearby existing generation and transmission infrastructure. An initial screening, using GIS data, was completed to select potential communities across the state.

3

Finally, the communities were evaluated using a quantitative scoring matrix to consider 19 criteria organized into six major categories weighted for their importance. The major categories considered were electric transmission, clean water supply, health & safety, environmental, and permitting considerations.

Note that the evaluation is based on a desktop review only and the communities have not been physically visited by the Project Team. Phase II of this Study is set to incorporate in-person community reconnaissance.

EXCLUSIONARY/AVOIDANCE ZONE IDENTIFICATION

The first step in the community selection process was the identification of exclusionary and avoidance zones as laid out by the NRC regulations which have been interpreted in the EPRI Nuclear Siting Guide. Exclusionary and avoidance zones are defined for two general purposes. The first purpose is to protect the proposed nuclear facility from external hazards. The second purpose is to protect identified zones from any potential radiation-related effects in the event of radiation release by the proposed nuclear facility.

Exclusionary zones are defined as areas within which an SMR facility could not be constructed and operated due to regulatory restrictions. Avoidance zones, however, could still support the construction and operation of an SMR facility but would not be preferred due to conditions outlined in the regulatory guidelines.

The methodology and results of the research and identification of exclusionary and avoidance zones are described in the following sections.

Health and Safety Criteria

Health and safety criteria were developed by EPRI as interpreted from NRC regulations to protect the public from potential radiation release events. The criteria are categorized into accident cause criteria and accident effects criteria. Each of these criteria are further defined in the following subsections.

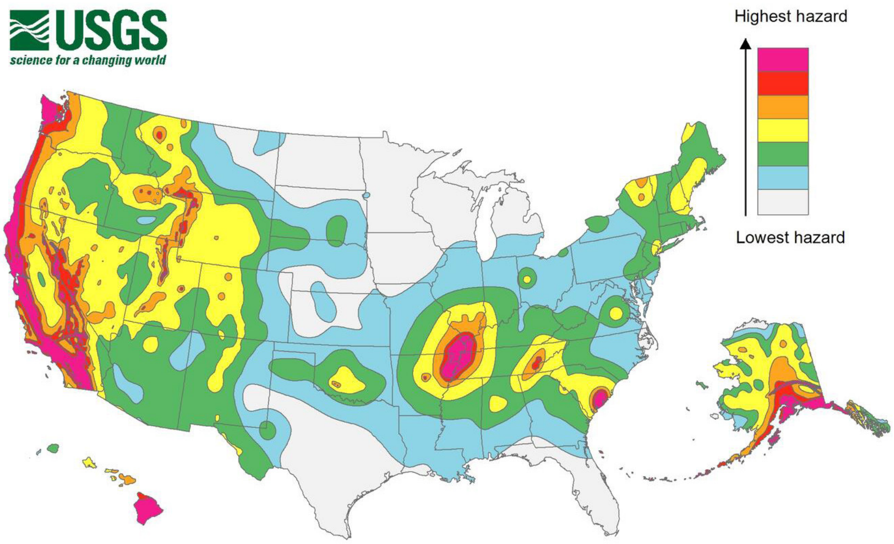
Accident Cause Criteria

Accident cause criteria includes considerations for events outside of the control of a proposed SMR facility that could cause a radiation release at a potential nuclear site, including seismic considerations, nearby hazardous land uses, and extreme weather conditions.

Seismic and Geological Considerations

Seismic regulations indicate that a Safe Shutdown Earthquake should be determined to establish a vibratory ground motion design basis. No design parameters currently exist for the proposed SMR site, and therefore a Safe Shutdown Earthquake magnitude could not be determined at this time. Still, the Project Team consulted maps produced in 2014 by the United States Geological Survey ("USGS") which assessed the probability of an earthquake exceeding 0.30g of peak ground acceleration over a 50-year period. The USGS found the state of Nebraska to be a low hazard risk for significant seismic activity. The nationwide map can be found below in **Figure 3-1**.

Figure 3-1: USGS Peak Ground Acceleration Seismic Hazard Map



Further, the Project Team identified and mapped the recorded earthquakes that have occurred in and surrounding Nebraska since 1900. No specific parameters for an exclusionary zone surrounding previous earthquakes were denoted within the NRC regulations, however areas with a history of geologic activity are generally considered undesirable. In total, 99 earthquakes were mapped and marked for avoidance. A summary table of the identified earthquake analysis can be found below in **Table 3-1.**

Table 3-1: Nebraska and Surrounding Area Earthquake Analysis Summary

Highest Magnitude	Lowest Magnitude	Mean Magnitude	Median Magnitude
5.1	2.0	3.2	3.1

Generally, an earthquake begins to cause damage to buildings and residential areas at approximately a 5.0 magnitude, while significant damage begins to occur at approximately a 6.0 magnitude. Nebraska has experienced a single earthquake exceeding a magnitude of 5.0 since 1900, indicating that the state is not typically susceptible to major earthquakes.

Nebraska has experienced a single earthquake exceeding a magnitude of 5.0 since 1900, indicating that **the state is not typically susceptible to major earthquakes**.

An additional seismic consideration includes identifying capable tectonic faults. No specific exclusionary or avoidance criterion were outlined by the NRC, however capable faults were considered undesirable. A capable fault was defined by the NRC as a fault with movement at or near the ground surface within the past 35,000 years or movement of a recurring nature within the last 500,000 years. As a valid initial approach, the EPRI Nuclear Siting Guide proposed an avoidance area which is proportional to capable fault length. The Project Team utilized the USGS Quaternary Fault Database to survey Nebraska for capable faults, and the database returned no surface faults in Nebraska which have experienced movement in the past 1.6 million years. As a precaution, the Humboldt Fault Line was mapped as an avoidance criterion.

The EPRI Nuclear Siting Guide identifies soil stability as an additional criterion to consider when siting a nuclear facility. The Project Team has not performed geotechnical work or soil testing at any of the proposed communities as of the writing of this report, and therefore no portion of the state was marked as an exclusionary zone based on soil quality. Still, the Sand Hills region of Nebraska was identified to have topsoil with relatively low soil stability and therefore was generally avoided during the initial phase of community screening. Additional geotechnical analysis should be performed on potential communities located within the region to confirm soil stability.

Nearby Hazardous Land Uses

NRC regulations indicated that nearby hazardous land uses should be avoided to protect the proposed SMR site from external hazard failure events. Further, the EPRI Nuclear Siting Guide proposed a five-mile exclusionary area surrounding significant manufacturing or chemical facilities, DoD grounds, oil pipelines, and major transportation routes. Additionally, a ten-mile exclusionary area surrounding major airports was recommended. The Project Team identified the various hazardous land uses during the preliminary screening of Nebraska, and other potential hazardous land uses were evaluated after the initial communities were selected. **Table 3-2** outlines the hazardous land uses identified during the initial screening of the state.

Table 3-2: Nebraska and Surrounding Area Earthquake Analysis Summary

Hazardous Facility Type	Number of Identified Areas	Exclusionary Radius (mi)
Major Airport	9	10
Ethanol Plant	22	5
Oil Pipeline	5	5
DoD Grounds	2	5
Transportation Route	2	5

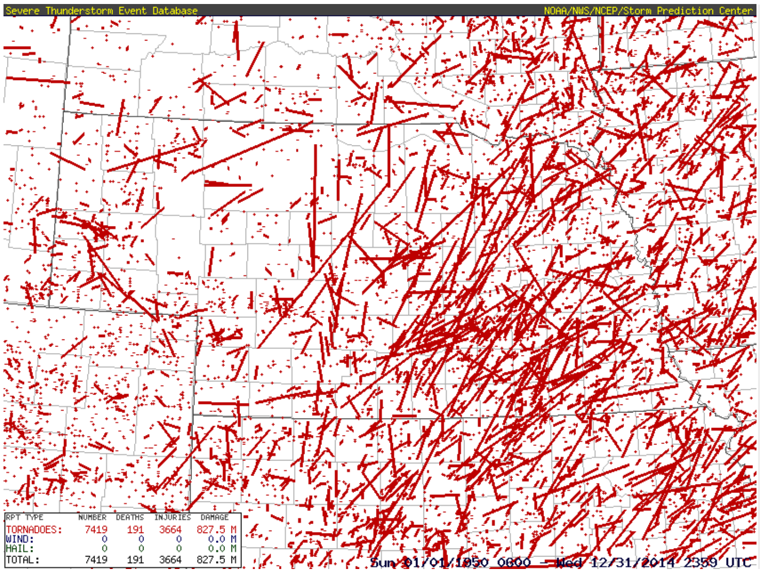
The major airports in Nebraska that were considered exclusionary for the Study were Omaha Eppley Field, Lincoln Airport, Kearney Regional Airport, Central Nebraska Regional Airport, North Platte-Lee Bird Regional Airport, Western Nebraska-Scottsbluff Regional Airport, McCook Ben Nelson Regional Airport. Alliance Municipal Airport, and Chadron Municipal Airport. In order to identify the ethanol plants in Nebraska, the Project Team consulted the Nebraska Ethanol Board's online database.

In total, 22 ethanol plants with significant manufacturing equipment and chemical storage facilities were marked as exclusionary. Major highways marked as exclusionary included I-80 running east-to-west through the center of the state and I-29 which runs parallel to the eastern border of the state. Additionally, the five major oil pipelines included as exclusionary were two branches of the Keystone Pipeline as well as the Platte, Jayhawk, and Pony Express Pipelines. Lastly, DoD areas marked for exclusion included Offutt Air Force Base and NG Mead Army Guard Base.

Extreme Weather Conditions

The EPRI Nuclear Siting Guide outlines guidelines for avoiding areas known to produce extreme weather conditions. These extreme weather considerations include tornadoes, high wind speed, large changes in pressure, and heavy precipitation events. The Project Team referenced a map produced by the University of Nebraska which utilized the Severe Thunderstorm Database to display all known tornado touchdowns and their associated paths in Nebraska between 1950 and 2014. The referenced map is shown below in **Figure 3-2**.

Figure 3-2: Map of Tornadoes in Nebraska 1950-2014



From 1950 through 2012, Nebraska averaged **42 tornadoes** per year state-wide.

From 1950 through 2012, Nebraska averaged 42 tornadoes per year state-wide, however Nebraska has only a single documented F5 class tornado. As displayed in Figure 3 2, tornadoes in Nebraska most commonly occur in the southeastern portion of the state, with the least number of tornadoes occurring in the Sand Hills region. Still, given the relatively high likelihood of a tornado in any area of Nebraska, the Project Team did not assign any exclusionary or avoidance zones based on tornado activity.

Accident Effects Criteria

Accident effects criteria includes SMR site characteristics that may pose a risk to external facilities, populations, or the environment in the case of a radiation release event at the proposed SMR site. Accident effects criteria includes distance to population, emergency planning, and various radionuclide pathways.

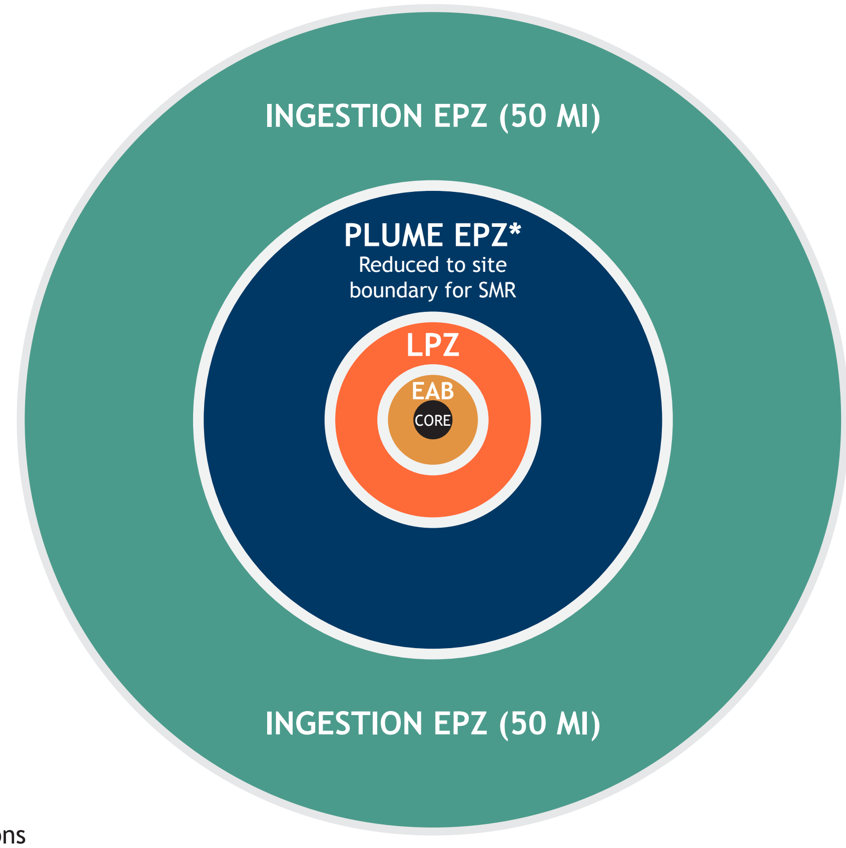
Population and Emergency Planning

NRC regulations define population and population density limits surrounding any potential nuclear generating station which applies to SMRs. More specifically, **NRC regulation 10 CFR 100.21** indicates that when considering a site for an SMR, four radial zones expanding outwardly from the reactor core must be determined for population control and planning. Historically, the outermost two boundaries were a 50-mile ingestion pathway **emergency planning zone ("EPZ")** and a **ten-mile plume exposure EPZ**. On October 19th, 2022, the NRC approved NuScale's methodology for reducing EPZ sizing for SMRs from the ten-mile plume exposure EPZ to the site boundary. The 50-mile ingestion pathway currently remains unchanged.

The innermost two zones are the **low population zone ("LPZ")** and the **exclusionary area boundary ("EAB")**. These two boundaries are determined by modeling a radionuclide release event. The **EAB** is set at the location at which a person no longer receives a dose exceeding 25 rem to the whole body over a two-hour period of exposure, and the **LPZ** is determined by the location at which a person no longer receives a dose exceeding 25 rem to the thyroid over a two-hour period of exposure. Further, the **LPZ** boundary must lie 1.333 times the distance from the reactor core to the boundary of a population center, and therefore a site must not be constructed within or adjacent to the border of a population center.

A visual representation of the population and emergency planning borders can be found in **Figure 3-3**.

Figure 3-3: Population and Emergency Planning Borders



In addition to the regulations, NRC Regulatory Guide 4.7 provides guidance that a reactor should preferably be located in such a place that the population density, including weighted transient population, averaged over any radial distance out to 20 miles, does not exceed 500 persons per square mile. Further, the guideline proceeds to define a population center as a population of roughly 25,000 residents.

The Project Team considered all readily available regulations and regulatory guidelines when identifying population centers and creating exclusionary zones based on population. In total, nine population centers with populations greater than 25,000 were identified utilizing 2020 U.S. Census data. Three of the population centers, Omaha, Papillion, and Bellevue were combined to form a greater Omaha metro area population center. In order to determine the radius of each population center's exclusionary zone radius, two equations were utilized. First, an exclusionary area was found utilizing the following

$$Area\ [mi^2] = \frac{Population\ [\#\ Persons]}{500\ \frac{Persons}{mi^2}}$$

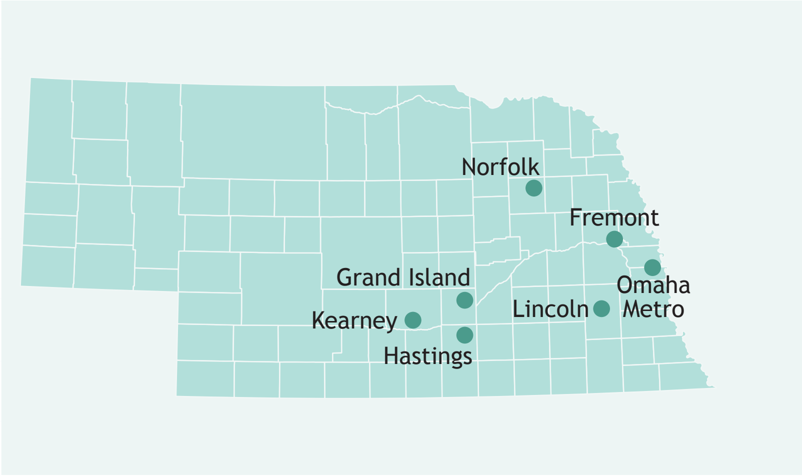
equation:

In total, **nine population centers** with populations greater than 25,000 were identified utilizing 2020 U.S. Census data.

Based on the circular area calculated with the equation above, the exclusionary zone radius was determined. The identified population centers and their calculated exclusionary zone radii are defined below in **Table 3-3**.

Table 3-3: Population Center Data

Population Center	Population	Exclusionary Radius (mi)
Omaha Metro	**968,000**	**24.82**
Lincoln	**298,000**	**13.77**
Grand Island	**54,000**	**5.86**
Kearney	**34,000**	**4.65**
Fremont	**27,000**	**4.15**
Hastings	**25,000**	**3.99**
Norfolk	**25,000**	**3.99**



Radionuclide Pathways

When siting a nuclear generating facility, **Title 10 of the Code of Federal Regulations** must be considered. Title 10 defines dose standards, including dose consequences for normal operations and post-accident scenarios. The dose standards must be calculated and simulated using detailed analysis, defined radionuclide sources, and site-specific criteria. Additionally, above ground water, below grade water, and food ingestion pathways should be considered.

As a more general approach for the purpose of the Study, the Project Team identified the nearest source of above ground water for each community and approximated downstream consumption. This consideration addressed the above ground water criteria within the scoring matrix. Communities with smaller tributaries or rivers with low irrigation or consumption levels were given the highest (best) possible score, whereas major rivers which provide water to a significant number of farms, manufacturing facilities, or residential areas were given the lowest (worst) possible score.

Additionally, potential communities were assessed for high levels of agricultural activity, including farms and livestock pastures to further address the food ingestion pathway criterion. Given the association between rural areas and the frequency of agricultural activity, the results of this siting criterion within the scoring matrix were generally considered acceptable.

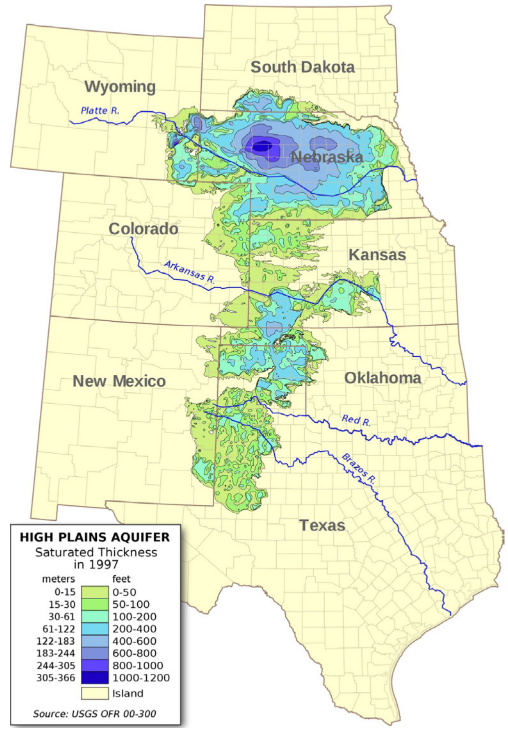
Potential communities were assessed for high levels of agricultural activity, including farms and livestock pastures to further address the food ingestion pathway criterion.

In relation to below grade water, or groundwater, the Project Team defined no specific siting criteria as it relates to radiation contamination. The NRC does regulate against the contamination of groundwater through maximum contamination levels ("MCLs") and references the EPA's Groundwater Protection Strategy during the licensing process. In contrast, the NRC notes in its whitepaper, *NRC Regulation of Groundwater Contamination*, that "While the groundwater protection strategy is an important regulatory tool, it is not a regulation but an agency strategy."

Nebraska lies above a large portion of the below grade High Plains Aquifer System, a shallow water table aquifer which supplies irrigation for agricultural activity and provides drinking water to communities throughout the state. A map of the High Plains Aquifer System is displayed in **Figure 3-4**.

The aquifer system lies below the vast majority of Nebraska, including the western, central, and eastern areas of the state. Further, additional secondary aquifers containing lower quality water exist on the eastern portions of the state.

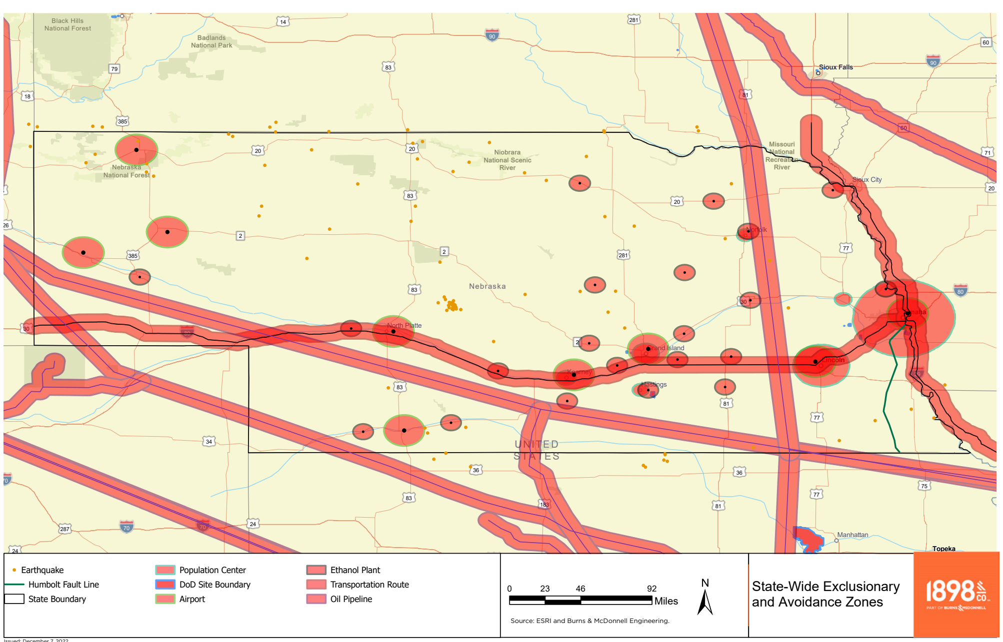
Figure 3-4: High Plains Aquifer System

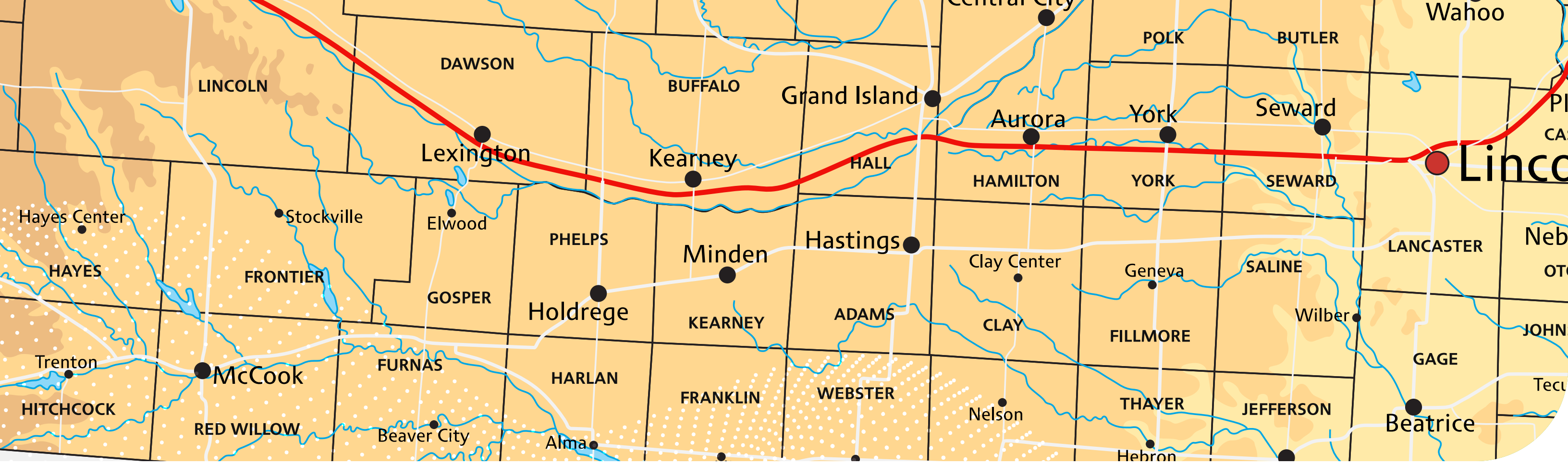


Exclusionary and Avoidance Zone Map

Each of the exclusionary and avoidance zones were evaluated and compiled into a single map to eliminate those areas of the state from consideration in the siting process. The complete exclusionary and avoidance map is displayed below in **Figure 3-5**.

Figure 3-5: Exclusionary and Avoidance Map





SELECTION OF CANDIDATE COMMUNITIES

After defining exclusionary and avoidance zones, candidate communities were identified. Candidate communities were determined through three methods:

1

The community contained an existing power generation facility in Nebraska.

2

Request from Nebraska Stakeholders was received to evaluate the community (municipal entity, NPPD, Omaha Public Power District ("OPPD"), etc.)

3

The Project Team review of critical infrastructure and exclusionary and avoidance zones identified the community as potentially suitable for an SMR site.

Once these communities were identified, each community was screened by considering exclusionary and avoidance areas, topography, parcel size, the presence of wetlands or floodplains, and distance to critical infrastructure. The Project Team used aerial photography and GIS databases to identify the potential communities that would be representative of each area. The methodology and results of these investigations are described in the following sections.

Areas of Interest

The Project Team considered communities throughout the entire state of Nebraska. The preliminary Areas of Interest ("AOI") include all communities with existing generating sites, the Loup Valley Public Power District ("LVPPD") service area, and the townships of Holdrege, Wahoo, and Norfolk. The specific communities selected as AOIs with existing generating sites included Sutherland, Fremont, Omaha, Grand Island, Hallam, Hastings, Beatrice, Lexington, Brownville, Blair, Nebraska City, Springfield, and Plattsmouth.

Regional Infrastructure

In order to minimize the potential impacts and costs of plant development, prospective communities should be located near supporting infrastructure and physical resources while supporting the overarching goals of the project's development.

Electric Transmission

The generating units at the proposed SMR facility must be connected into the regional transmission network to deliver electric power from these facilities to end users. For this Study, it was assumed that a minimum transmission line voltage of 69 kV would be required with a preference to 115 kV or higher.

When determining the point of interconnection, the Project Team utilized 1898 & Co. internal construction cost estimates for substation and transmission lines to determine approximate transmission interconnection upgrade costs. In addition to the cost of interconnection, it is important to understand the ability to be able to deliver the electricity to the load. In Nebraska, most of the electric load is located in the eastern portion of the state. It is preferable to construct generation near the load in order to reduce the potential for transmission congestion. In order to evaluate the potential for congestion, the Project Team utilized the marginal congestion component of the **Locational Marginal Price ("LMP")** from the **Southwest Power Pool ("SPP")** data at various existing generating locations. This data was used to create a map of regional congestion. The map was used for each community to approximate transmission congestion in the region. Communities located
in the western panhandle were assumed to have high transmission congestion due to the lack of high voltage transmission lines exiting the region flowing east.

Wastewater Infrastructure

This Study has assumed that the proposed SMR facility would be preferably located in a region with a high wastewater sustainability risk. The DED developed a datasheet set in conjunction with Wichita State University that evaluates the wastewater infrastructure sustainability risk of a town or city on a scale of 1-30. Then, a high, moderate, or low risk is assigned based on the sustainability risk number the location received. A high or moderate risk would be preferable for a potential community; however, a low risk assessment was not evaluated as a fatal flaw.

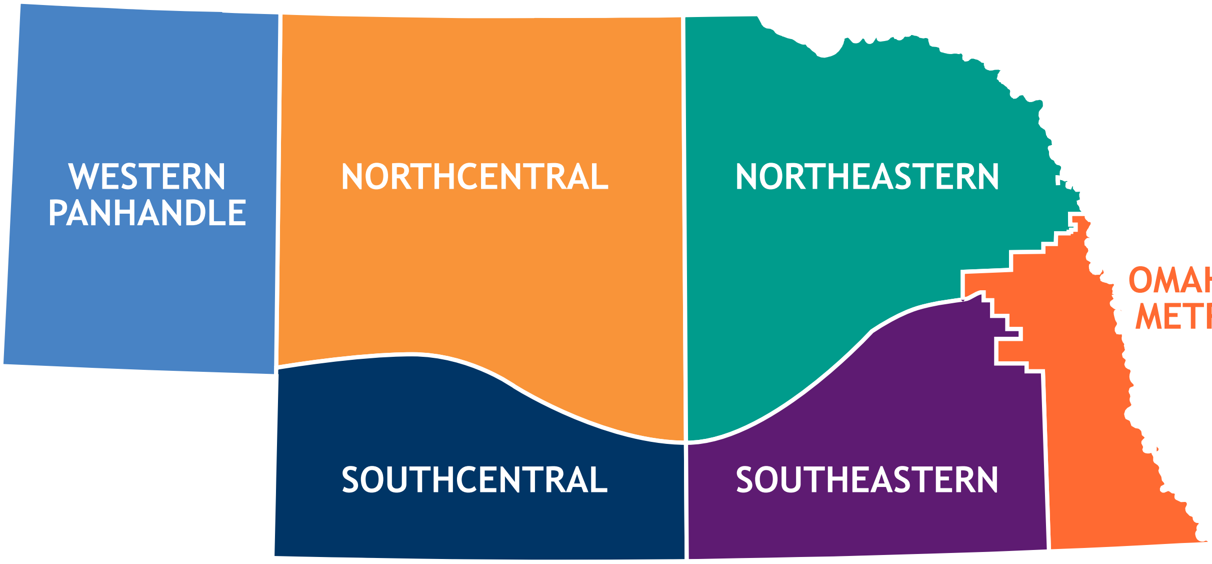
Land Availability

Based on discussions with those involved in SMR facility development, the Project Team estimates that a facility would require approximately 40-65 acres to support an SMR. This was used as a basis for determining land availability at each potential candidate community. Further, the Project Team evaluated each community to determine potential land use and zoning issues.

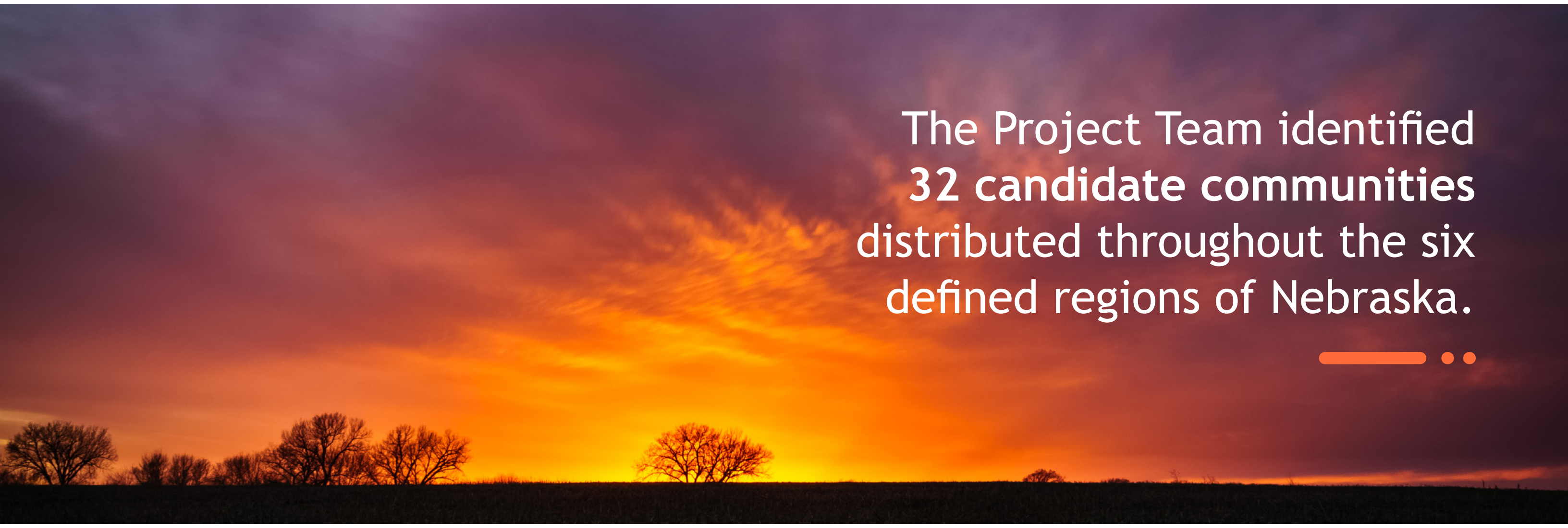
Preliminary Candidate Communities

The state was divided into six regions throughout Nebraska over which the selected communities were distributed. The six regions include the western panhandle, northcentral, southcentral, northeastern, southeastern, and Omaha metro and are displayed below in **Figure 4-1**.

Figure 4-1: Defined Regions of Nebraska



From this analysis, the Project Team identified **32 candidate communities** distributed throughout the six defined regions of Nebraska. The pool of selected potential communities included 14 communities with existing generating sites and 18 communities without existing generating sites.



CANDIDATE COMMUNITY EVALUATION

A quantitative decision matrix was used as a tool to aid in ranking the candidate communities. The first step in using such a process is to identify the objectives or criteria to be used to evaluate the alternatives to communities selected for evaluation. The process used to select the candidate communities was based on consideration of each of the major characteristics required for construction of an SMR facility such as electric transmission infrastructure and wastewater sustainability impacts. Therefore, candidate communities have already been assessed to have the necessary basic infrastructure and are assumed to meet minimum requirements for construction of an SMR facility. For this reason, the focus of the candidate community evaluation and of the criteria discussed in this section was to assess the relative advantages and disadvantages of each candidate community.

The evaluation criteria used to judge the relative suitability of each candidate community with respect to its own ability to support a SMR facility covers a number of specific attributes. Each of these attributes represent a characteristic that is important in the evaluation of prospective communities and also serves to differentiate the candidate communities from one another. These evaluation criteria are not equivalent in their importance to the decision-making process. Therefore, each criterion was also assigned a weight indicative of its relative importance to the decision-making process. Criteria with the highest weight are considered the most critical for SMR development and on-going project success. The assignment of weights to the evaluation criteria was a subjective process based on the collective professional judgment of the NPPD and 1898 & Co. staff who participated in this Study.

The evaluation criteria used to judge the relative suitability of each candidate community with respect to its own ability to support a SMR facility covers a number of specific attributes.

Each of the criterion used to evaluate the candidate communities were first organized into six major categories, and these categories were allocated weights that totaled 100 percent. For example, the Electric Transmission category was assigned a weight of 25 percent, and therefore 25 percent of the overall evaluation scores were based on Electric Transmission criteria. Within each major category, more specific criteria were assigned sub-weights indicative of each criterion's relative importance. The composite weight for each individual criterion is then calculated as an aggregate of all sub-weighted criteria within a major category. The evaluation categories, category weights, criteria, criteria sub-weights, and composite weights are summarized in **Table 5-1**. A detailed discussion of each of these criteria, which includes the rationale used to assign the score for each criterion, for each of the 32 candidate communities are located in the below subsections.

Table 5-1: Candidate Community Evaluation Criteria & Weighting

Category Weight	Criterion	Criterion Weight	Composite Weight
25%	**Electrical Transmission**		
	Transmission System Congestion	40.0%	10.0%
	Distance to Transmission Interconnect	60.0%	15.0%
7%	**Clean Water Supply**		
	Improve Water Quality	100.0%	7.0%
15%	**Health & Safety**		
	Distance to Population Center	50.0%	7.5%
	Downstream Water Usage	25.0%	3.8%
	Hazardous Facilities	25.0%	3.8%
25%	**Site Development**		
	Accessibility	15.0%	3.8%
	Constructability	25.0%	6.3%
	Usable Site Area	20.0%	5.0%
	Water Availability	25.0%	6.3%
	Workforce Availability	15.0%	3.8%
18%	**Environmental**		
	Nearest Noise Receptor	10.0%	1.8%
	Environmental Justice	20.0%	3.6%
	Wetlands	25.0%	4.5%
	Floodplains	25.0%	4.5%
	Archaeological & Cultural Resource Risk	10.0%	1.8%
	Sensitive Species Risk	10.0%	1.8%
10%	**Permitting**		
	Land Use & Zoning	50.0%	5.0%
	Class 1 Areas	50.0%	5.0%

Electrical Transmission

The Electrical Transmission category, which was assigned a **total weight of 25 percent**, was comprised of two component evaluation criteria. These criteria are described in the following subsections.

Distance to Transmission Interconnection

During the community selection process, priority was given to communities with closer proximity to existing transmission infrastructure. A desktop review was conducted to approximate distances to nearby points of transmission line interconnection and points of high voltage substation interconnection. Interconnection voltage is not currently factored into the weighting of the decision matrix and all transmission voltages (69 kV and up) were considered in order to select a number of communities in each area of the state. Interconnect voltage requirements will depend on the size of SMR which is constructed, and no capacity range has been decided to date.

Criteria	Score
Less than two miles	50
Between two and four miles	30
More than four miles	10

Communities that were less than two miles from the most cost-effective point of interconnection received a score of 50, communities that were between two and four miles from the most cost-effective point of interconnection received a score of 30, and communities that were more than four miles from the most cost-effective point of interconnection received a score of 10.

Transmission System Congestion Analysis

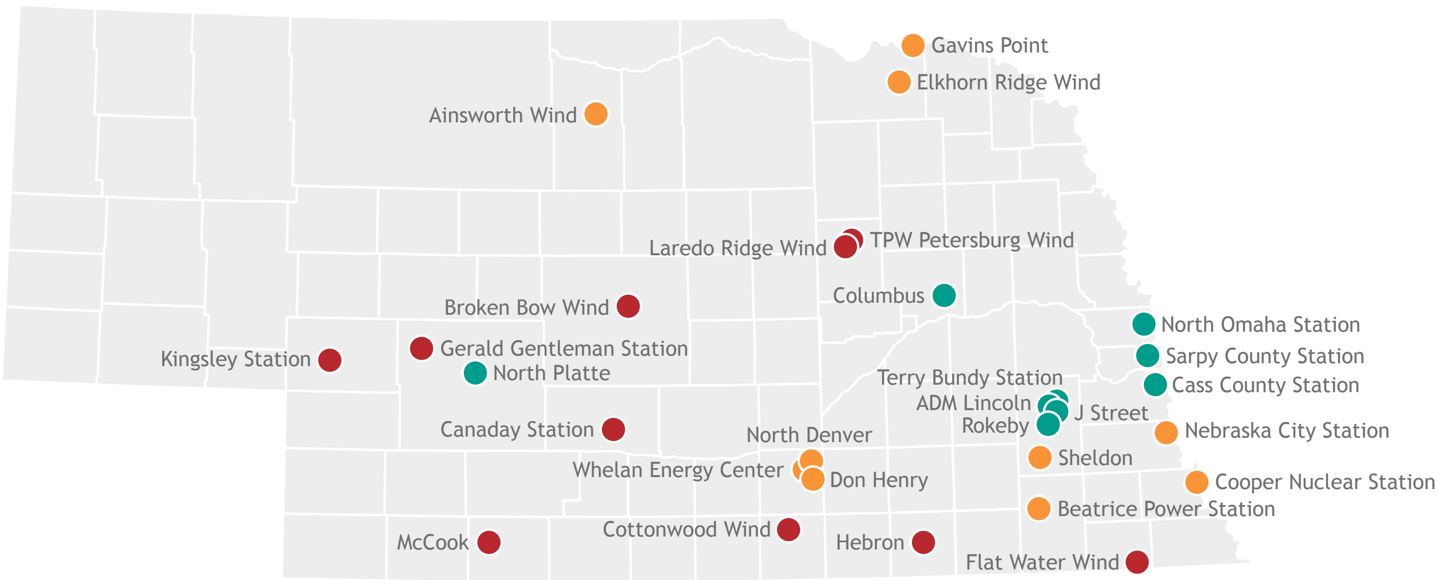
In addition to the cost of interconnection, it is important to understand the ability to be able to deliver the electricity to the load. In Nebraska, most of the electric load is located in the eastern portion of the state. It is preferable to site generation near the load in order to reduce the potential for transmission congestion. To evaluate relative levels of congestion across the state, the Project Team consulted publicly available Locational Marginal Price ("LMP") data from the Southwest Power Pool ("SPP"). Within the SPP, historical LMP data is available at major substations of existing generation sites, referred to as LMP Nodes. In total, the Project Team identified 30 LMP Nodes within the state of Nebraska.

At each LMP Node, the LMP is calculated using the following formula:

LMP	=	MEC	+	MLC	+	MCC
Locational Marginal Price		Marginal Energy Cost		Marginal Loss Cost		Marginal Congestion Cost

For the purpose of evaluating congestion at each LMP Node, the Project Team utilized only the MCC portion of the LMP calculation for 2021 and 2022. Each LMP Node's MCC value is determined by evaluating the change in SPP transmission losses that would result in a one MW injection at the node. LMP Nodes with a higher negative MCC value experience higher congestion, and LMP Nodes with a lower negative MCC value experience lower congestion. MCC values ranged from the lowest MCC value of -180.6 at North Omaha Station to the highest MCC value of -401.1 at Gerald Gentleman Station. The MCC data was then used to create a map of Nebraska displaying relative congestion across the state, shown in **Figure 5-1**. No data points were available to the west of Kingsley Station, and therefore sites west of Kingsley station were assumed to have high transmission congestion in relation to the rest of the state based on the data presented. The ten LMP nodes with the highest relative average congestion were marked in red, the ten LMP nodes with moderate relative average congestion were marked in yellow, and the ten nodes with the least relative average congestion were marked in green.

Figure 5-1: Relative Transmission Congestion in Nebraska



Congestion data from each of the 30 LMP nodes were cross-referenced with the 32 candidate communities. If a candidate community was near an LMP node and would be interconnected to the same transmission infrastructure in the area, the community was scored the same as its established congestion ranking in **Figure 5-1**. For other communities, the congestion score was evaluated utilizing the established congestion ranking of nearby LMP nodes in combination with a general analysis of relevant transmission infrastructure, anticipated direction of electric flow, and nearby populated areas which may have a higher electric load.

Candidate communities which would be replacing existing generation or have a low average transmission congestion received a score of 50, communities with a moderate average transmission congestion received a score of 30, and communities with a high average transmission congestion received a score of 10. For example, Broken Bow received a 10 as the nearest LMP node was Broken Bow Wind, which was measured to have high transmission congestion in relation to the rest of the state.

Water Infrastructure Improvement

The Water Infrastructure Improvement category, which was assigned a total weight of seven percent, was comprised of a single evaluation criterion. The criterion is described in the following subsection.

Improve Water Quality

This Study was funded by the State of Nebraska Nuclear Plant Siting Feasibility Study Program ("NPSFSP"), and the Study was performed with the intention that partial funding for the construction of the proposed SMR facility would be granted through the NPSFSP. The NPSFSP receives its funding from the United States Department of Treasury's Coronavirus State & Local Fiscal Recovery Funds ("SLFRF"). For the construction of an SMR to be eligible for funding under the SLFRF and through the NPSFSP, this Study must demonstrate that the funds dispersed for construction of an SMR would be used to finance the generation and delivery of clean power to a wastewater system or water treatment plant.

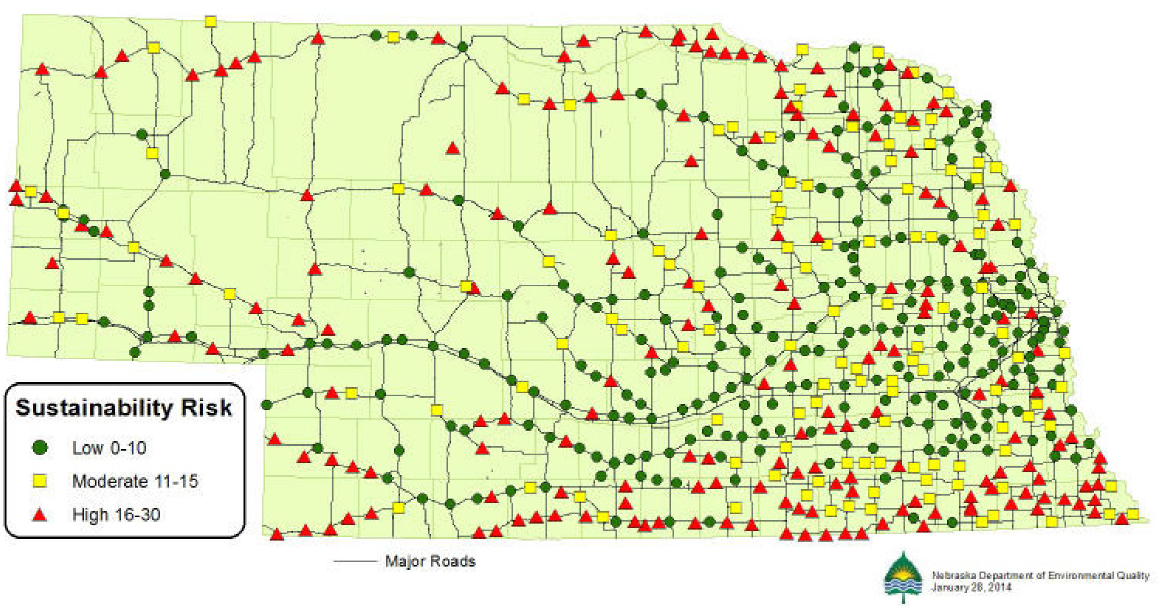
Criteria	Score
High wastewater sustainability risk area	50
Moderate wastewater sustainability risk area	30
Low wastewater sustainability risk area	10

In order to evaluate areas of the State of Nebraska in need of supplemental clean energy to power wastewater systems and water treatment facilities, the Project Team utilized the Assessing Wastewater Infrastructure Needs ("AWIN") Sustainability Model. The AWIN tool was created by the Nebraska Department of Environment & Energy ("NDEE") in conjunction with the Wichita State University Environmental Finance Center to evaluate each Nebraska community's wastewater sustainability risk. The AWIN tool analyzes and considers each community's population trends, economic status, and resources to determine the ability to pay for future infrastructure needs and evaluates the wastewater infrastructure sustainability risk on a scale of 1-30. The model utilizes data from multiple data sources, including the 2000 and 2010 US Census, the 2008-2012 American Community Survey, and the Wichita State University Finance Center decision-making tool. Then, a high, moderate, or low risk is assigned based on the sustainability risk number the location received. **Table 5-2** outlines the sustainability risk rankings as determined by NDEE and Wichita State University, and **Figure 5-2** displays a state-wide map of the evaluated sustainability risks for various communities across Nebraska.

Table 5-2: AWIN Sustainability Model Scoring Methodology

AWIN Sustainability Risk Category	AWIN Sustainability Risk Score
Low Risk	**1-10**
Moderate Risk	**11-15**
High Risk	**16-30**

Figure 5-2: AWIN Sustainability Model State of Nebraska



http://dee.ne.gov/NDEQProg.nsf/OnWeb/AWIN

A site located in a high wastewater sustainability risk area received a score of 50, a site located in a moderate wastewater sustainability risk area received a score of 30, and a site located in a low wastewater sustainability risk area received a score of 10. Results of the improving water quality evaluation is displayed below in **Table 5-3**.

Table 5-3: Improve Water Quality Evaluation Scores

Site Name	Risk Ranking | Risk Score	Site Name	Risk Ranking | Risk Score
Genoa	Low, 2	Wauneta	High, 22
Holdrege	Low, 4	Stamford	High, 16
Nebraska City	Low, 9	Ainsworth	High, 19
Plattsmouth	Moderate, 12	Emerson	Low, 9
Bennington	Low, 2	Valentine	Low, 4
Blair	Low, 1	Springfield	Low, 5
Norfolk	Low, 5	Sutherland	Low, 5
Wahoo	Low, 1	Fremont	Low, 6
Broken Bow	Low, 7	Omaha*	Low, 6
Spencer	High, 20	Grand Island	Low, 3
Falls City	Moderate, 15	Hallam	Low, 3
Humboldt	High, 24	Hastings	Low, 3
Lyman	High, 20	Beatrice	Moderate, 11
Crawford	High, 24	Lexington	Low, 6
Rushville	High, 24	Brownville	High, 25
Thedford	Low, 9	Kearney	Low, 3

*This site was initially considered as part of the study due to grant requirements involving existing generation facilities. This site is not being considered for future study phases at this time.

Health and Safety

The Health and Safety category, which was assigned a total weight of 15 percent, was comprised of four component evaluation criteria. These criteria are described in the following subsections.

Distance to Population Center

As described in Regulatory Guide 4.7, a reactor should be located away from densely populated centers. Specifically, the reactor should be sited in an area in which the population density of a nearby population center does not exceed 500 people per square mile. Communities which were more than ten miles from the border of a population center were assigned a score of 50. Communities which were less than ten miles from the border of a population center were assigned a score of 30. Communities which were located inside a population center border received a score of 10.

Criteria	Score
More than ten miles	50
Less than ten miles	30
Inside a population center	10

Downstream Water Usage

In the unlikely scenario of a radiation exposure event, the pathways through which radioactive material could travel must be identified. One of the primary pathways through which radioactive material could travel is surface water. If the water within these rivers, creeks, or lakes is used for irrigation, industrial use, or consumption, it could contaminate nearby materials and people. The Project Team identified nearby surface water to each of the communities and evaluated its level of potential downstream consumption. Communities with nearby surface water which had low levels of potential downstream consumption scored a 50. Communities with nearby surface water which had moderate levels of potential downstream consumption scored a 30. Communities with nearby surface water which had high levels of potential downstream consumption scored a 10.

Criteria	Score
Low levels of potential downstream consumption	50
Moderate levels of potential downstream consumption	30
High levels of potential downstream consumption	10

Hazardous Facilities

NRC regulations dictate that areas with hazardous facilities or land uses should be avoided to protect the proposed SMR facility in the event of an external hazard failure. Further, the EPRI Nuclear Siting Guide proposed a five-mile exclusionary area surrounding significant manufacturing or chemical facilities, DoD grounds, oil pipelines, and major transportation routes. Additionally, a ten-mile exclusionary area surrounding major airports was recommended. The Project Team identified the various hazardous facilities and land uses and evaluated candidate communities based on distance to the hazardous land use. Communities located more than 15 miles from an airport or ten miles from a hazardous land use received a score of 50. Communities located more than 10 miles from an airport or five miles from a hazardous land use received a score of 30. Communities which were located within ten miles of an airport or five miles of a hazardous land use received a score of 10.

Criteria	Score
More than 15 miles from an airport or ten miles from a hazardous land use	50
More than 10 miles from an airport or five miles from a hazardous land use	30
Within ten miles of an airport or five miles of a hazardous land use	10

Site Development

The Site Development category, which was assigned a total weight of 25 percent, was comprised of five component evaluation criteria. These criteria are described in the following subsections.

Accessibility

To reduce the likelihood for new road construction and facilitate easy access to the potential SMR facility, a candidate community should have adequate existing transportation infrastructure, including paved roads suitable for large equipment deliveries and heavy construction traffic. Road access was scored based on a desktop review of roads within the community. Communities which were highly accessible from either entry roads or highways were assigned a score of 50. Communities which were moderately accessible from either entry roads or highways were assigned a score of 30. Communities which are non-accessible from either entry roads or highways were assigned a score of 10.

Criteria	Score
Highly accessible	50
Moderately accessible	30
Non-accessible	10

Constructability

The geology and terrain that currently exists within each community will contribute to the construction cost of an SMR facility. Ideally, the SMR site would require minimal grading and clearing with a deep water table to allow for the reactor structures to be constructed underground (approximately 80 feet below grade) without significant dewatering. Communities with favorable terrain and deep water table received a score of 50. Communities with a shallow water table or moderate grading receive a score of 40. Communities with significant elevation change (substantial grading requirements) receive a score of 30. If a community has a low water table and substantial grading requirements, then a score of 10 was assigned.

Criteria	Score
Favorable terrain and deep water table	50
Shallow water table or moderate grading	40
Significant elevation change	30
Low water table and substantial grading	10

Usable Site Area

The intent of the Study was to evaluate a community's potential to support a SMR facility. One factor that must be considered for construction is the amount of land available for development, as well as additional land needed for a buffer zone around the facility for staging and equipment laydown. An estimated minimum usable site area is 60 acres for a single-module SMR. Communities with greater than 60 acres of usable terrain received a score of 50, communities with between 40 and 60 acres of usable terrain received a score of 30, and communities with less than 40 acres of usable terrain received a score of 10.

Criteria	Score
Greater than 60 acres of usable terrain	50
Between 40 and 60 acres of usable terrain	30
Less than 40 acres of usable terrain	10

Water Availability

The Project Team investigated the availability of well/ground water and municipal water sources in each of the candidate communities. Surface water was not included in the evaluation, as site-specific permitting, regulatory, and environmental considerations would require a more detailed investigation and included in future phases. The evaluation consisted of a high-level analysis of each community based on the presence of aquifers below each of the communities and the capacities of nearby wells to estimate ground water availability. Aerial imagery was utilized to approximate each community's municipal water infrastructure. The ground water evaluation did not account for water permitting, water quality, or long-term water availability. A site-specific evaluation of aquifer geology and characteristics, water availability, water quality, and water permitting is recommended.

Criteria	Score
Above aquifers with readily available ground water	50
Above aquifers with potential water availability via multiple smaller wells or readily available municipal water supply	30
No evident nearby water source	10

Based on the investigation, communities located above aquifers with readily available ground water sources received a score of 50. Communities located above aquifers with potential water availability via multiple smaller wells or readily available municipal water supply received a score of 30. Communities with no evident nearby water source received a score of 10.

Workforce Availability

Workforce availability is critical in maintaining safe and reliable operation of an SMR facility. The Project Team evaluated nearby populations and infrastructure to estimate nearby workforce availability. Candidate communities which would replace existing generation and therefore would have experienced operators in the region received a score of 50. Communities within ten miles of an area with a population greater than 10,000 residents and therefore a recruitable workforce received a score of 30. Communities far from populated areas that could be challenged to recruit operators received a score of 10.

Criteria	Score
Experienced operators in the region	50
Populated areas within ten miles and therefore recruitable workforce	30
Far from populated areas that could be challenged to recruit operators	10

Environmental

The Environmental category, which was assigned a total weight of 18 percent, was comprised of six component evaluation criteria. These criteria are described in the following subsections.

Nearest Noise Receptor

There are a number of factors that contribute to whether the Project will produce noise, visual, dust, or odor impacts during construction and operation of the facility. However, the number of such receptors in close proximity to a prospective site is one variable that can be measured. To determine potential impacts created by developing the Project within each community, a desktop review of nearby noise receptors, inhabited buildings, was performed using aerial photography. Communities with nearest receptors that are greater than a mile away received a score of 50. If the nearest receptor is between 0.25 and one mile away, then the community received a score of 30. If the nearest receptor is less than 0.25 miles, then the community received a score of 10.

Criteria	Score
Nearest receptors that are greater than a mile away from the site	50
Nearest receptor is between 0.25 and one mile away from the site	30
Nearest receptor is less than 0.25 miles from the site	10

Wetlands

Wetlands are a federally regulated resource. Any impacts to wetlands must generally be mitigated by creation of a like or greater number of wetlands at a nearby location. To determine the likelihood of impacting wetlands/streams during the development of a given power plant facility at each community's representative parcel, USGS topographic maps, aerial photography, and USFWS NWI maps were reviewed. The density of wetlands, streams, ponds, and appearance of low-lying areas were used to determine potential wetland impacts. Communities that have the highest potential for avoiding wetland impact received a score of 50, moderate potential for avoiding wetlands received a score of 30, and the lowest potential for avoiding impacts received a score of 10.

Criteria	Score
Avoiding wetland impact	50
Moderate potential for avoiding wetlands	30
Lowest potential for avoiding impacts	10

Floodplain

Critical infrastructure, including power plant facilities, are critical resources that must remain operational during adverse weather conditions such as flood events. Therefore, the major facilities must be located outside of the floodplain, or otherwise protected from flooding by raising the site above floodwater levels or constructing levees. In addition, construction of a nuclear site within a floodplain may cause the unintended release of radioactive materials. Further, any construction within a floodplain that could have the unintended effect of increasing floodwater levels upstream should be avoided.

Criteria	Score
Located outside of 100-year floodplains	50
Within 100-year floodplains but with potential developable area	30
Located within 100-year floodplains with limited developable	10

Federal Emergency Management Agency ("FEMA") Flood Insurance Rate Map ("FIRM") data was reviewed to determine floodplain locations relative to each community's representative parcel. The maps were downloaded from readily available Internet resources. In cases where FEMA flood data was not available, data from the EPA's Climate Change Database was used to locate potential floodplain concerns. Communities with representative parcels located outside of 100-year floodplains received a score of 50; those located partially within 100-year floodplains but with potential developable area received a score of 30; and those located within 100-year floodplains with limited developable area received the lowest score of 10.

Archaeological & Cultural Resource Risk

A preliminary desktop review was conducted to determine the likelihood of impacting cultural resources during the development of the facility within each community. The Project Team reviewed the cultural resources database maintained by the Nebraska State Historic Preservation Office and federal cultural resources databases such as the National Register of Historic Places ("NRHP"), historic topographic maps, historic aerial photographs, soils, hydrology, and geological data.

Criteria	Score
Lowest potential for impacts to cultural resources	50
Moderate potential to impact resources	30
Highest potential for impacts to cultural resources	10

USGS topographic maps, aerial imagery, and soils, hydrologic, and geologic datasets were consulted for additional landscape analysis. Factors such as slope, distance to permanent water sources, surface stability, soil texture, landform, and modern and historic land use were used (in concert with cultural datasets referenced above) to help assess the potential for intact precontact or historic-age archaeological sites. This landscape analysis is critical for areas that have not been subject to archaeological survey in the past.

Communities with the lowest potential for impacts to cultural resources received a score of 50. Communities with moderate potential to impact resources received a score of 30. Communities with the highest potential for impacts to cultural resources received a score of 10.

Sensitive Species Risk

To determine the likelihood of impacting threatened or endangered ("T&E") species or their respective habitat during the development of the proposed SMR facility, a high-level analysis was performed to identify T&E species that could occur within the potential communities. The USFWS IPaC online tool was used for analysis of potential risks to local wildlife resulting from the development of the Project, including impacts to federal- and state-protected species.

Criteria	Score
Low expectation of impacts	50
Moderate expectation of impact	30
High expectation of impact	10

Regulatory guidance for compliance with the USFWS would include efforts to evaluate the Project risks under the Endangered Species Act , Migratory Bird Treaty Act ("MBTA"), and Bald and Golden Eagle Protection Act ("BGEPA"). USFWS consultation for the Project under the ESA should consider the affects to protected species and designated critical habitats.

State species considered threatened, endangered, or candidates to be listed were also analyzed at a high level for each county. There are a number of listed species that can occur at each site, but for which there is no critical habitat designated. The northern long-eared bat and the monarch butterfly were common to all sites. Most sites also have potential for migratory birds to be present. Owing to the existing land uses having heavily disturbed the areas and minimal, if any, applicable critical habitat, avoidance shouldn't require considerable effort.

Generally, a 10 to 50 scoring system was used for each community, relative to the expected potential for impacts to T&E species. A low expectation of impacts was scored a 50, a moderate expectation of impact was scored 30, and a high expectation of impact was scored a 10.

Permitting

The Permitting category, which was assigned a total weight of ten percent, was comprised of two component evaluation criteria. These criteria are described in the following subsections.

Land Use & Zoning

Brownfield and industrial zoned sites are preferred to avoid the need to re-zone a site. Thus, communities having existing brownfield sites with industrial zoning were assigned a score of 50. Representative parcels that are currently being used for agriculture and farming purposes were also assigned a score of 30 due to their ease to rezone. Representative parcels comprised of undistributed terrain, forested or otherwise, were assigned the lowest score of 10.

Criteria	Score
Existing brownfield sites with industrial zoning	50
Currently being used for agriculture and farming purposes	30
Comprised of undistributed terrain, forested or otherwise	10

Class 1 Area Proximity/Impact

Class 1 Areas are federal lands that receive special air quality protection under Section 162(a) of the Clean Air Act. National parks, wilderness areas, and monuments can fall under Class 1 Area protection. To determine potential impacts created by developing the project within each community, a desktop review of nearby Class 1 Areas was conducted using data assembled by EPA's Office of Air Quality Planning and Standards, and various federal agencies, including the National Park Service, U.S. Forest Service, and USFWS. A community located greater than 150 kilometers from the nearest Class 1 Areas received a score of 50. If the nearest Class 1 Area is between 100 and 150 kilometers away from the community, then the community received a score of 30. If the nearest Class 1 Area is within 100 kilometers, then the community received a score of 10.

Criteria	Score
Greater than 150 kilometers	50
Between 100 and 150 kilometers	30
Within 100 kilometers	10

Evaluation Summary

The individual scores for each candidate community and criterion were used along with the corresponding weights to calculate a weighted composite score for each site. These composite scores are calculated as the sum of the products of each individual score and criterion weight. **Table 5-4** provides a tabular representation of the weighted composite scores for the candidate community evaluation split into the top communities.

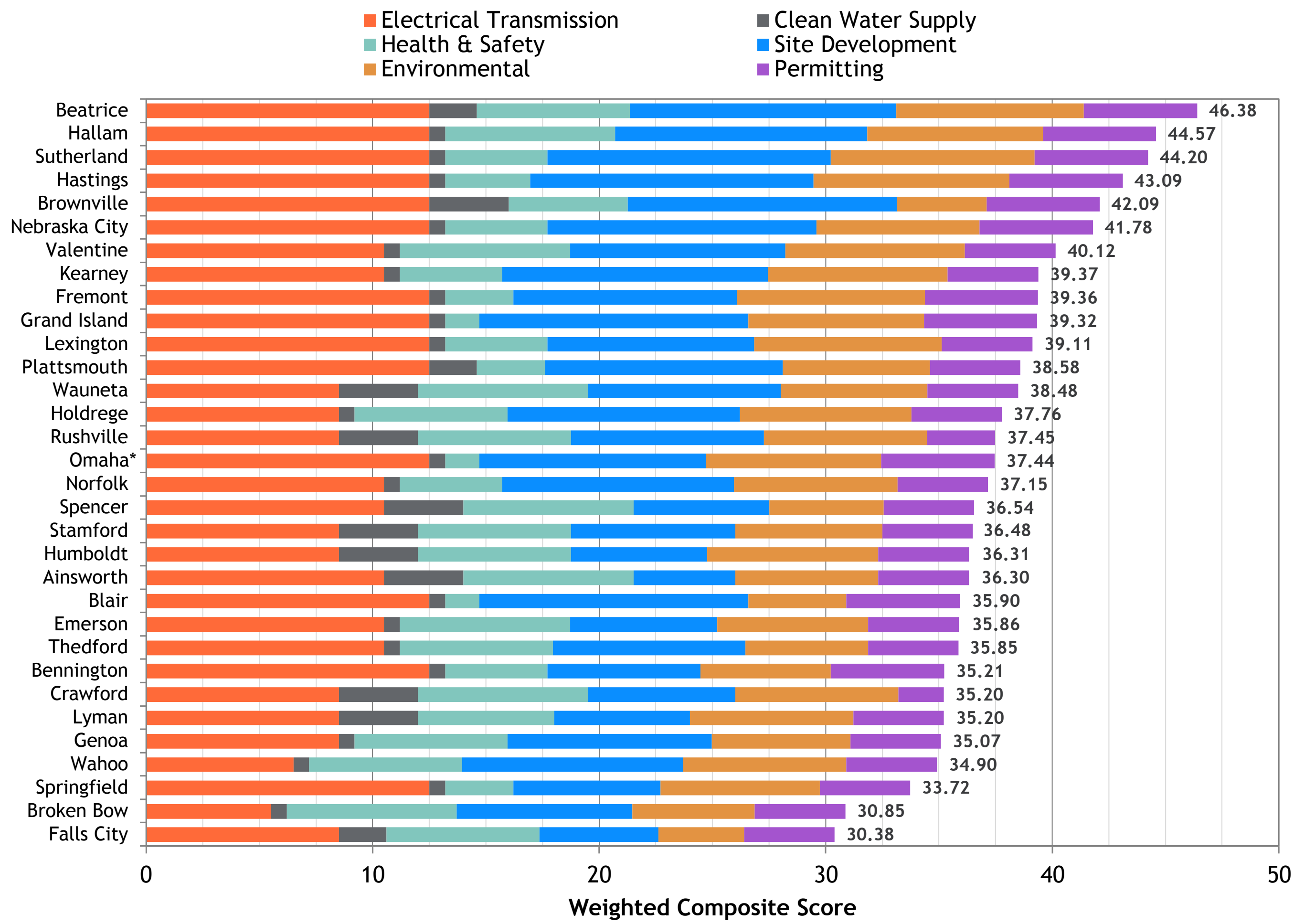
Table 5-4: Top Candidate Communities Major Category Weighted Scores

Rank	Community	Composite Score	Electric Transmission Score	Clean Water Supply Score	Health & Safety Score	Site Development Score	Environmental Score	Permitting Score
Major Category Weight ▶		100%	25%	7%	15%	25%	18%	10%
1	Beatrice	46.38	12.50	2.10	6.75	11.75	8.28	5.00
2	Hallam	44.57	12.50	0.70	7.50	11.13	7.74	5.00
3	Sutherland	44.20	12.50	0.70	4.50	12.50	9.00	5.00
4	Hastings	43.09	12.50	0.70	3.75	12.50	8.64	5.00
5	Brownville	42.09	12.50	3.50	5.25	11.88	3.96	5.00
6	Nebraska City	41.78	12.50	0.70	4.50	11.88	7.20	5.00
7	Valentine	40.12	10.50	0.70	7.50	9.50	7.92	4.00
8	Kearney	39.37	10.50	0.70	4.50	11.75	7.92	4.00
9	Fremont	39.36	12.50	0.70	3.00	9.88	8.28	5.00
10	Grand Island	39.32	12.50	0.70	1.50	11.88	7.74	5.00
11	Lexington	39.11	12.50	0.70	4.50	9.13	8.28	4.00
12	Plattsmouth	38.58	12.50	2.10	3.00	10.50	6.48	4.00
13	Wauneta	38.48	8.50	3.50	7.50	8.50	6.48	4.00
14	Holdrege	37.76	8.50	0.70	6.75	10.25	7.56	4.00
15	Rushville	37.45	8.50	3.50	6.75	8.50	7.20	3.00
16	Omaha*	37.44	12.50	0.70	1.50	10.00	7.74	5.00
17	Norfolk	37.15	10.50	0.70	4.50	10.25	7.20	4.00

*This site was initially considered as part of the study due to grant requirements involving existing generation facilities. This site is not being considered for future study phases at this time.

Figure 5-3 is a graphical representation of the weighted composite scores for the candidate community evaluation based on the tabular data above.

Figure 5-3: Candidate Community Evaluation Scores



*This site was initially considered as part of the study due to grant requirements involving existing generation facilities. This site is not being considered for future study phases at this time.

Table 5-4 and **Figure 5-3** show that the base composite evaluation scores range from a low of 30.38 for the Falls City community to a high of 46.38 for the Beatrice community. The average and median scores are 37.81 and 37.30, respectively. Based on the average and median scores of the evaluation, the Project Team selected a score of 37 as the cutoff for top sites selected for evaluation in Phase 2 of this Study.

REGULATION SENSITIVITY

Due to the ongoing development of SMR technologies, discussions and alterations to policies and regulation associated with the technology are evolving. Specifically, the current regulations regarding siting advanced reactors near population centers is being disputed. Current regulations require an applicant to create a boundary surrounding densely populated centers and site potential reactors 1.33 times the distance from the LPZ to the population center border. Since SMRs are smaller compared to traditional nuclear reactor units the cores will require less radioactive material which could result in a reduction in the distance requirements from population centers.

On July 13, 2022, the NRC Regulatory Commission approved a new approach for evaluating where advanced reactors, including SMRs, can be sited. The 2-1 vote in favor of Option 3 of NRC Policy Issue SECY-20-0045 allows the siting of advanced reactors within densely populated areas through the estimation of radiological consequences from design-specific events rather than a general correlation of offsite doses to radionuclide inventories or power level. Additionally, the integrated safety performance of the entire reactor design would be considered. Prior to the vote, individual developers such as the Nuclear Energy Institute and the Nuclear Industry Council determined Option 3 to be the preferred option to move forward with as Option 3 achieves the goal of reducing regulatory uncertainties and providing a process by which advanced reactor attributes are credited to provide operational flexibility.

The approval of SECY-20-0045 Option 3 does not necessarily have an immediate effect on the siting of an SMR, as additional rulemaking by the NRC will be necessary and is estimated to take years to be written and approved. Further, public perception and potential pushback of any new rulemaking must be considered when siting an SMR within a population center. A poor public reception to the siting of an SMR in an urban area may pose unintended business and reputational risks.

In order to address these ongoing regulation changes, the Project Team created a second quantitative scoring matrix. The matrix utilizes the same categorical breakdown as the original scoring matrix discussed in Candidate Community Evaluation section, but the weighting of each line item was examined and altered. The overarching goal of the second scoring matrix was to lower the weighting impact of siting a potential SMR facility within a population center. Notable variance from the existing regulation matrix to the new regulation matrix includes a 4.0% reduction in composite distance to population center weighting, a 2.0% percent reduction in composite downstream water usage and hazardous facilities weighting, and a 2.0% of composite improvement of water quality weighting.

The weighting comparison of the existing regulation scoring matrix and the new regulation scoring matrix is presented below in **Table 6-1**.

Table 6-1: Scoring Matrix Weighting Comparison

Criterion	Existing Regulation Matrix Weighting		Future Regulation Matrix Weighting	
	Criterion	Composite	Criterion	Composite
Electrical Transmission	**25%**		**27%**	
Transmission System Congestion	40.0%	10.0%	40.0%	10.8%
Distance to Transmission Interconnect	60.0%	15.0%	60.0%	16.2%
Clean Water Supply	**7%**		**9%**	
Improve Water Quality	100%	7.0%	100%	9.0%
Health and Safety	**15%**		**7%**	
Distance to Population Center	40.0%	7.5%	40.0%	3.5%
Downstream Water Usage	25.0%	3.8%	25.0%	1.8%
Hazardous Facilities	25.0%	3.8%	25.0%	1.8%
Site Development	**25%**		**27%**	
Accessibility	15.0%	3.8%	15.0%	4.1%
Constructability	25.0%	6.3%	25.0%	6.8%
Usable Site Area	20.0%	5.0%	20.0%	5.4%
Water Availability	25.0%	6.3%	25.0%	6.8%
Workforce Availability	15.0%	3.8%	15.0%	4.1%
Environmental	**18%**		**20%**	
Nearest Noise Receptor	10.0%	1.8%	10.0%	2.0%
Environmental Justice	20.0%	3.6%	20.0%	4.0%
Wetlands	25.0%	4.5%	25.0%	5.0%
Floodplains	25.0%	4.5%	25.0%	5.0%
Archaeological and Cultural Resource Risk	10.0%	1.8%	10.0%	2.0%
Sensitive Species Risk	10.0%	1.8%	10.0%	2.0%
Permitting	**10%**		**10%**	
Land Use and Zoning	50.0%	5.0%	50.0%	5.0%
Class 1 Areas	50.0%	5.0%	50.0%	5.0%

The updated weighting criteria caused changes in the overall rankings of the communities. Generally, no major restructuring occurred, as communities which scored well with existing regulations scored similarly with future regulations.

CONCLUSIONS

Siting Study Conclusions

As part of the site selection process, 1898 & Co. proposed a three-phase plan to identify, prioritize, and evaluate potential candidate communities for new SMR generation. This Report covers the first phase of the effort to identify top potential candidate communities from each of the six regions of the state of Nebraska to carry into Phase 2. The conclusions reached from this Study are presented below.

1	Beatrice*	2	Hallam*	3	Sutherland*	4	Hastings*	5	Brownville*
6	Nebraska City*	7	Valentine	8	Kearney	9	Fremont*	10	Grand Island*
11	Lexington*	12	Plattsmouth*	13	Wauneta	14	Holdrege	15	Rushville
16	Omaha**	17	Norfolk						

**This site was initially considered as part of the study due to grant requirements involving existing generation facilities. This site is not being considered for future study phases at this time.

When identifying candidate communities, exclusionary/avoidance zones were generally avoided. However, several communities with existing generation sites were evaluated despite being located in an exclusionary/avoidance zone, including Omaha, Grand Island, Plattsmouth, Fremont, Sutherland, Hastings, Nebraska City, and Lexington. Existing generation sites offer significant benefits such as transmission access, water availability, and carbon emissions reductions that warrant further consideration. Since several of these communities with existing generation sites scored among the top potential communities, these communities should be further assessed in Phase 2.

1898 & Co. recommends NPPD conduct further due diligence on the top communities which includes:

- Meet with each of the top candidate communities to engage community discussion and receive valuable feedback in an effort to assess community support and build community relationships.
- Determine representative site parcels and begin further property due diligence.
  - Performing site reconnaissance in Phase 2 of this Study to confirm the findings of the desktop review performed in this report.
- Perform a transmission interconnection study at each of the sites to identify any issues associated with interconnection constraints.
- Perform detailed site evaluations in Phase 3, including boundary and topography surveys, an ESA, an environmental critical issues assessment, and geotechnical borings.