NORTHEASTERN NEVADA INDUSTRIAL HEMP PROCESSING PLANT FEASIBILITY REPORT

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Abstract

A report summarizing the current market potential and barriers to successfully planting and processing industrial hemp (non-CBD) in North-Central Nevada.

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INTRODUCTION

The following report is prepared in response to a Request for Proposals from the Northeastern Nevada Regional Development Authority dated November 8, 2019. This study was completed in accordance with KMR's proposal dated January 23rd, 2020.

It is our understanding that NNRDA desires to develop a feasibility proposition for creation of an industrial hemp processing facility within Humboldt County, Nevada. We understand that there are several farmers in the region that are currently growing industrial hemp for extraction of CBD but that a robust market for the hemp byproducts (fiber, hurd, hemp seed oil, etc.). does not exist at this time. It is the desire of NNRDA to examine the economic potential for building a hemp processing facility that would allow primary processing for raw industrial hemp materials. This work focuses on industrial byproducts only does not include market review for CBD or any related chemical components of the hemp. This work identifies first-tier market gateways for hemp biproducts. The veracity of the identified gateways correlate to the feasibility of the overall processing plant feasibility.

In accordance with KMR's proposed approach this report provides four primary areas of focus in support of the study objectives.

1. Historic Assessment of Industrial Hemp in the US and Nevada
2. Market Study for Industrial Hemp Products
3. Technical Assessment of Northern Nevada Market Potential
4. Barrier to Entry Assessment

During the research portion of this project our team confirmed that the current state of information regarding industrial hemp is unreliable. Since IH was re-criminalized immediately after the Second World War there has been no organized governmental effort to track IH markets and products within the United States. Simultaneously there has been little government or industry funded research into the hemp industry since criminalization. There is, therefore, a lack of peer-reviewed research or publication of valid market data to rely upon. At decriminalization of IH in 2018 a gold-rush mentality struck the entire cannabis industry leading to enormous capital flows into the cannabis space. As a sideline to cannabis, IH has gained significant investor interest and many journalistic (non-peer reviewed) articles regarding the future of IH have appeared. These publications and websites are largely meant to drive positive sentiment and internet traffic and seem to provide little market or process intelligence of value.

This report's approach to market intelligence relies on first-hand development of market data

through rigorous historical research and live interviews. To the extent possible, the information and conclusions presented herein are based on original information sourced and cultivated by KMR. Although cumbersome, this method provides the most reliable and realistic assessment of market conditions and allows for the most accurate feasibility assessment. Although we consider this data accurate it is difficult to ground-truth and the data points are sparse. With fewer data points comes higher data risk. We therefore discourage use of this report as a primary financial instrument or basis of a business plan but rather as supporting document to a well-researched business plan. No warranties, expressed or implied are made.

HEMP VS. CANNABIS

Since antiquity, industrial hemp (IH) has taken on a near-mythical status as a multi-function plant. Hemp, not to be confused with today's regulated "Cannabis", can be utilized in a variety of high-value industries. Hemp fiber is used to create cordage and rope and hemp textiles are renowned for their light weight and durability. Hemp oil is used in lubricants, plastics, cosmetics, and as a direct food. Hemp meal is a high-protein, low saturated fat additive to baked goods and animal feeds. Even the pithy core of the hemp plant, the hemp hurd, has uses in plastics, as absorbents, and in building materials like Hemp-Crete.

While Industrial Hemp and Cannabis (Marijuana) are the same species, they have been specialized to provide differing byproducts. By today's definition, IH must contain less than 0.3 percent by mass tetrahydrocannabinol (THC) as tested by High Performance Liquid Chromatograph. THC is the psychoactive substance in Cannabis and is the target of modern regulation. Any THC value larger 0.3 percent will result in classification of the plant as a controlled substance and therefore in the jurisdiction of the Federal Drug Enforcement Agency (DEA). Industrial hemp with THC values lower than 0.3 percent are subject to much lower regulatory oversight and are presided upon by the Federal Food and Drug Administration.

1. HISTORIC ASSESSMENT

– KMR will research and summarize the global historic and emerging uses of "below-the-flower" industrial hemp. We feel this will be a valuable starting point for acquiring meaningful market information regarding current and future use of industrial hemp in the US. We will summarize historic uses of primary hemp biproducts including fiber, hemp hurd (plant core), and hemp oil and will identify secondary materials uses (fabric, plastics, building materials, etc.).

History of Hemp in America

The use of hemp as a primary fiber and food crop easily predates the founding of the United States of America. According to several historians, the first planting of hemp in the future United States commenced in the early 1600's near Jamestown, Virginia. By 1616 Jamestown was producing enough industrial hemp for use in cordage and textiles. Most of this hemp was processed on the farm and woven into rustic ropes and cloth for domestic use. In 1619 King James I issued an edict requiring every Jamestown farmer to grow at least 100 hemp plants annually for export to England. This hemp found its way into the ropes and canvas of the fabled English Navy. Similar hemp decrees were later passed for Connecticut and Massachusetts, eventually turning North America into England's primary source of cordage fiber.

Despite its labor intensity, the Founding Fathers were enamored with hemp. George Washington, Thomas Jefferson, and James Madison held hemp plantings. Benjamin Franklin founded and owned a mill that used hemp fiber and hurd to make paper; reportedly, early drafts of the Declaration of Independence were written on hemp paper.

By the 1840' the US was producing upwards of 15,000 tons of hemp fiber products per year. As the Civil War loomed, this number increased to 40,000 tons per year. The primary use was cordage and canvas but products including hemp paper, hemp meal, and hemp oils flourished. It is reported that Abraham Lincoln eschewed whale oil for hemp oil in the lamps of the White House during his presidency. Hemp production in Northern States increased dramatically during the Civil War to support the war effort as the demand for cordage, canvas, and other hemp byproducts skyrocketed.

The demand for IH began to wane after the Civil War and as steamships became more and more popular in the late industrial revolution, IH plantings plummeted. More and modern technology helped to supplant labor-intensive hemp with more mechanized cotton harvesting. The first World War saw an uptick in hemp demand but also resulted in dramatically increased demand for cotton as cotton cellulose became a high-value ingredient in munitions and high-explosives.

In 1923 a man named George Schlichten developed a more modern hemp decorticator that eased much of the labor burden of hemp processing. This led to a minor resurgence of hemp production as competition to the growing cotton industry. The market for hemp held stable, even gaining a nod from Henry Ford during the great depression as he searched for alternative materials for his production lines. Hemp plantings as a percentage of cotton dwindled during the early part of the 20th. After the end of the Spanish-American war and under US administration, the Philippines became a major producer of sisal fiber. This cheap fiber put additional pressure on domestic hemp producers as Philippine labor was much, much cheaper than domestic labor.

The true end of 20th century IH began in 1935 when the DuPont corporation received patents for its new, synthetic fiber, Nylon. This material was made from cheap raw materials, was easy to manufacture, versatile, and made high-quality and durable goods. In an effort to bolster their product sales and market share, DuPont and (members of the paper pulp industry) attacked hemp. DuPont began an aggressive lobbying campaign to link hemp to marijuana and to villainize the psychotropic properties of both. This effort was largely successful and spawned fear of marijuana as a degenerate drug (Reefer Madness). The final-result of this campaign was the passage of 1937's Marihuana Tax Act. This act placed a large excise tax on dealers of marijuana or hemp products with the result of destroying the domestic hemp industry by 1940.

Hemp planters received an unexpected reprieve when, at the outbreak of the US involvement in WWII, Japan invaded the Philippines on December 8, 1941. This invasion immediately disrupted the supply of sisal fibers to the United States Navy. The United Stated Department of

Agriculture responded by creating an excise tax exemption program titled "Hemp for Victory" which resulted in approximately 150,000 acres of new domestic hemp by 1945. This program was rescinded in 1947. It is reported that despite the vast excise tax the last 20th century commercial crop of IH was planted in Wisconsin in 1957 with the resulting fiber being sold for rope.

In 1970 the US Congress passed the Controlled Substances Act which classified IH as a Schedule I Drug. The passage of this act effectively ended all commercial IH cultivation and provided criminal penalties for such.

Since the passage of the 1970 Act, small groups of industry representative and enthusiasts have worked tirelessly to decriminalize hemp. The FDA allowed imported hemp oil and hemp seed for foods into the USA in 1998. In 2004 the US Ninth Circuit of Appeals Court protected hemp-based foods and body products within the US. In 2007 the DEA granted experimental licensure to two hemp farmers in North Dakota. In 2014 the Obama Farm Bill allowed for experimental hemp planting licensure and university research on hemp. In 2016 a formal Hemp Decriminalization Bill was introduced. All of this culminated in the 2018 passage of the Trump Administration's 2018 Farm Bill which removed hemp and hemp seeds from the list of controlled substances and placed hemp regulation within the FDA rather than the DEA.

The United States Department of Agriculture published the interim final rule for federal hemp production on Oct. 31, 2019 – nearly 11 months after passage of the 2018 Farm Bill

The return of legal hemp brought an avalanche of investment and interest hemp and hemp products. This legislation created the CBD oil boom and Farmers licensed over 500,000 acres of hemp across 34 states in 2019. Less than half of this hemp was, in fact, planted and the majority that was planted went unharvested. Of the hemp that was actually planted and harvested, the vast majority was utilized for CBD oil resulting CBD sales to over $1 billion in 2019

Uses of Industrial Hemp

The decriminalization of hemp has spurred a massive level of investment into hemp R&D. Outside of CBD there are numerous research organizations, universities, and companies that are trying to discover and re-discover the product possibilities of the hemp plant.

Hemp itself is comprised a pithy core (hurds) surrounded by a fibrous sheath (bast fiber). There is a leafy crown that, when allowed to flower can produce CBD or hemp seed. The traditional uses of hemp utilize all aspects of the plant.

- Fiber – the primary historical use of the hemp plant was its bast fiber. When properly processed and woven into ropes or textiles this fiber is light-weight, UV resistant, and durable. There is some evidence that hemp rope retains strength and ductility even when heated, leading to a preference for fire and rescue operations. Hemp cloth is durable and more resistant to abrasion than cotton. When Levi Strauss began manufacturing his line of pants he chose hemp over cotton. Currently, the Patagonia company offers a line of pants sewn from imported hemp fabric.

  Traditionally bast fiber was utilized in conjunction with hemp hurd to manufacture paper. There is increased interest in revitalizing this antiquated technology to offset the demand for paper pulp and it's related carbon and environmental deficits.

  In addition to rope and textile products there are modern research efforts focused on other potential uses of bast fiber. Bast fiber is being tested as a micro-reinforcement in bioplastics and composites which could transform the automobile and prosthetics industries to a lower-carbon, higher performance material. Further research has shown that when pyrolized, bast fiber can make an excellent micro-fiber activated carbon. The filtration potential of this material is beginning to be explored but could result in revolutionary applications in air, water, and food purification technologies.

- Hurd – The pithy interior core of the plant is also referred to as "shives" or "core fiber". This material is lightweight and highly absorptive. Historically this material has been used as an animal bedding, a soil improvement agent, and as the base for hemp paper. Approximately 95 percent of hemp hurd in the European Union today is sold as animal bedding as it's high absorption capacity and biodegradability is superior to other options. Modern research is focusing on hemp hurd as a raw ingredient in low carbon bio-cellulose plastics. The mesoporous nature of the hurd makes it an excellent candidate for pyrolization into bio-char or activated carbon and a likely candidate for high-performance filter media.

There is tremendous alternative-culture interest in the use of hurds as a construction material in the form of “HempCrete”. This material is used infrequently in Europe and has been for over a thousand years. HempCrete is a mixture of hemp hurds and hydrated lime that can set and develop a low level of strength suitable for structural infill projects. The resulting material is lightweight, insulative, and carbon-negative. While there is a fledgling interest in this material in European markets, substantial research and development would be required to make this concept into a primary material in the North American Market due to rigorous building codes.

- Hemp Seed Oil – Hemp seed oil is derived from the unripe hemp seed grown on a female plant. Hemp oil is cold-expeller extracted similar to other seed oils or extra virgin olive oil. The hemp seed contains up to 49 percent hemp oil by mass. Historically hemp oil has been used as a high-quality lubricant and a wood preservative as it dries and polymerizes similar to boiled linseed oil. Hemp oil has been a stable ingredient in oil paints and other pigments and has been used as such for centuries.

  Culinary uses of hemp seed oil date back to prehistory. The oil itself is high in polyunsaturated fats and contains high levels of Omega 6 and Omega 3 fatty acids. Due to its low smoking point hemp seed oil is not suitable for frying and is used primarily as a salad oil and dietary supplement in modern kitchens. Due to its favorable ratios of fatty acids and polyunsaturated fats, hemp seed oil is a desirable ingredient in natural body care products. Our research demonstrates a robust market for hemp seed oil food and personal care products (soaps, shampoos, lotions, etc.)

  Additionally, hemp seed oil is an appropriate feed stock for some bioplastics and can easily be utilized in the production of biodiesels. Due to an existing market structure in the food and personal care industry and due to the variety of proven uses for it we feel that hemp seed represents the most direct path to market for any IH derived byproduct.

- Hemp Seed Meal – Both historically and today the hull of the hemp seed is ground after oil extraction. The resulting seed meal is high in protein and in both soluble and insoluble fiber. There is a current market for this product as a dietary supplement for both human and livestock use. As a byproduct of hemp seed oil production hemp seed meal could allow for early access to an existing and robust market.

MARKET STUDY

Market Study – Based on the historic assessment, KMR will evaluate the regional market potential for industrial hemp biproducts. This work will focus on the historic uses and market segments for industrial hemp and will provide a summary of potential

emerging markets. We will locate and interview existing hemp market participants and will identify potential market partners for Nevada-grown and branded industrial hemp biproducts. Due to the unique legal status of industrial hemp in the United States we do not anticipate finding a thriving primary market for industrial hemp at this time. Our preliminary research indicates that primary hemp raw materials are being utilized in small quantities by boutique, secondary materials producers. We will attempt to summarize current status of use and will utilize this information to create speculative market size and valuation models.

As anticipated, KMR did not find evidence of a thriving domestic marketplace for all components of raw industrial hemp. Despite centuries of use as a high-value agricultural staple, the market for domestically produced industrial hemp has been all but destroyed by the 1970 Controlled Substance Act. The American economy has largely found inexpensive substitutions for hemp biproducts and those substitutions are now part of a solid and profitable materials market. There is, however, an encouraging market presence for several separate IH components including hemp seed oil and hemp seed meal. At the time of this writing four states supply the majority of domestic IH. Kentucky, Nebraska, and the Carolinas are the primary domestic growers, but these states do not have fully mature grower/processor relationships. For the purposes of this study, we consider domestic IH to be a purely emerging market subject to large swings in supply/demand and pricing.

The vast majority of hemp fiber products and related products are imported from South Asia and China. Lesser amounts of hemp fiber are imported from Canada and some hemp fiber products are imported from Eastern Europe. There is a dearth of accurate market data for IH but based on our extensive research it is our opinion that most of the US hemp production is utilized for CBD production. The development of a robust domestic IH supply chain will be entirely disruptive to the existing market

Based on this It is estimated that nearly 115,000 acres of hemp were grown domestically in 2019. MOST of this was wasted in the field as raw hemp processing facilities and downstream product markets simply do not exist domestically. The following market information was acquired through historic research and through interviews with producers, distributors, and retailers. KMR has provided a market breakdown for each of the primary components of the IH plant. Pricing and market information is estimated based on agglomeration and review of available pricing information and similar product comparisons. Data concerning potential crop yields is sparse at best. Some effort to quantify production potential was made by the USDA in the mid 1990's but KMR views this information as unreliable as dry-stem production values varied between 2 and 12.7 tons per acre. For purposes of this study we have assumed use of a climate optimized IH strain in near ideal conditions. Based on our review of available information we have made the following estimates:

- It is estimated that hemp could produce up to 1,000 lb of hemp seed and up to 3.0 tons of raw bast fiber per acre and up to 6 tons of hurd per acre. Hemp bast fiber must be degummed and combed before it's useable in the textile industry. These values are considered standard for this report but will vary greatly depending on factors including grower experience, weather, and seed genetics.

- There is very thin data but the estimated costs for growing hemp is approximately $375.00/acre. The plant is seemingly well suited to Northern Nevada but genetics have not yet been optimized for our climate.

Hemp Fiber - There is a minor, emerging domestic market that is centered around several small domestic fiber processors. There is a single, newly opened mill in North Carolina that is producing domestic hemp cloth at a reasonable scale and another plant in Northern California that is capable of production. The North Carolina plant called HEM Mills, is the nation's first primary hemp weaver to open in over 70 years. In order for Nevada hemp fiber products to gain any market share on the nascent national market the growers must offer a quality processed and degummed fiber. The domestic market for this product is currently saturated with fiber being sourced in the Carolinas and Kentucky but there is minor opportunity for Nevada products.

KMR expects degummed and combed hemp fiber to trade at approximately $0.12/lb. This pricing will go down DRAMATICALLY as more downstream producers and processors come online and hemp gains market traction. For hemp to gain larger market acceptance and price parity with cotton, enough downstream capacity must be constructed for hemp to be a viable competitor to cotton. At the time of this writing cotton trades at $0.62/lb***. Based on our anticipated production and cost values a grower can expect gross revenue of $720.00 per acre for degummed hemp bast fiber at this time.*** It is important to note that the existing domestic hemp fiber markets are nascent and are currently dominated by domestic growers from Kentucky, Nebraska, and the Carolinas. KMR estimates that the available market for Nevada produced hemp fiber is approximately 400 tons and growing at this time. **This translates into a maximum Nevada industrial hemp growth potential of approximately 133 acres for 2021.** Anything beyond this value will have a much more difficult time gaining market entry and will likely result in sunk cost. This value will increase on an annual basis related to investment in down-stream processing capability (decortication, degumming, and combing capacity). The market limits on oil, milled seed, and hurd are much larger than the fiber market and are not considered limiting factors in relation to fiber demand. The target market for processed hemp fiber is fiber spinning mills. At the time of this writing the group Fibershed documents a total of five (5) American companies that are capable of processing degummed and combed hemp fiber into yarn suitable for spinning and ultimately weaving.

Hemp Hurds – Screened and cleaned hemp hurd can be utilized as a low-cost animal bedding. Penetration of this market can be nearly immediate and can proceed both a local and regional level**. *We estimate an approximate revenue of $0.03/lb for hemp hurd resulting in a potential earning of $360/acre.*** KMR recommends wholesaling

cleaned, screened, and packaged screened hurds directly to regional animal supply retailers. We expect a ready market as stall and coop bedding and a nearly immediate path to cash flow for this product.

Hempcrete is not a viable market opportunity at this time but may emerge as a potential market for hurd as more academic research is focused on alternative building materials. There may be a smaller opportunity to sell hurds into bioplastics or paper markets but these avenues will require intensive investigation and development. Similarly, there may be a market for pelletized hemp hurd and organic waste as an inexpensive biomass for use in furnaces, etc. This market segment will require exploration and development but may be capital intensive and not offer a lower return on investment.

Hemp Seed Oil – Hemp seed can yield up to 25% hemp oil by mass when cold expeller pressed. Properly pressed, filtered, and packaged hemp seed oil currently wholesales for approximately $1.75/lb into the food and supplement markets. We anticipate a similar wholesale price structure for the cosmetics and personal care markets. ***With an expected yield of 1,000 pounds of hemp seed per acre a grower could realize 250 pounds or $437.50 per acre in gross revenue related to hemp seed oil.*** Processing costs for hemp seed oil could reach $0.50/lb resulting in a net revenue of $1.25/lb of hemp seed oil or $312.50/acre. It is KMR's opinion that hemp seed oil represents the most accessible market opportunity for industrial hemp products. We have identified a number of farmer-to-wholesale and farmer-to-retailer opportunities that could rapidly generate cash flow for this product.

Hemp seed meal - Similar to hemp seed oil there is an immediate market demand for hemp seed meal. This product is currently utilized as a nutritional supplement and can be found at a growing number of grocery outlets including an increasing number of main-stream markets. It is our estimate that properly prepared and packaged hemp seed meal has a wholesale market value of approximately $0.09/lb as a high protein agricultural/FDA feed supplement. ***With approximately 750 pounds of hemp seed meal per acre, this product could result in an additional revenue potential of $67.50/acre.***

Nevada Industrial Hemp Estimated Revenue Per Acre 2021

Product	Estimate Mass Per Acre Pounds	Estimated Revenue Per Pound	Estimated Total Revenue Per Acre	Estimated Annual Market Limit (2021)
Hemp Bast Fiber	6,000	$0.12	$720.00	400 Tons
Hemp Hurds	12,000	$0.03	$360.00	800 Tons
Hemp Seed Oil	250	$1.75	$437.50	100 Tons
Hemp Seed Meal	750	$0.09	$67.50	50 Tons

Gross Revenue/Acre	--	--	**$1,585.00**	**133 Acres**
IH Primary Processing	--	$0.022	**$411.40**	**$54,716.20**

Based on available industry information, KMR anticipates a total cost of $375.00 per acre to plant, maintain, and harvest industrial hemp in Nevada***. At this cost the net revenue potential for Nevada Industrial Hemp is approximately $1,210/acre. It must be noted that KMR anticipates a hard market limit of 400 tons of fiber for 2021. Based on assumed production rates this corresponds to a maximum profitable planting acreage of 133 total acres in Nevada for all growers.*** This limit will organically increase on an annual basis as whole-plant processing facilities become more readily available and as hemp products increase market their market share in the coming years.

The estimated revenue potential reflects the total value of IH per crop acre including the cost of primary processing. Hard market data is unavailable but based on general industry cost analysis, KMR estimates that decortication and processing costs could comprise up to 34 percent of the total net revenue potential. This equates to a potential revenue of $411.40 per acre of IH for processing services alone. **For the anticipated 2021 market size of 133 acres the estimated processing cost/total revenue is $54,716.20.**

It must be noted that these estimated production values are based on reviews of available industry literature and are purely speculative for Nevada's climate. These estimates may represent a best-case-scenario and should be updated if/when Nevada-specific industry data becomes available.

Marketing Approach

Accelerated demand for Nevada hemp could be created by obtaining vertical integration in an in-state market sector. For example, by investing in a company that fabricates sustainable shopping bags a grower could increase demand for hemp cloth and therefore locally grown fiber. By investing in a small soap or cosmetics operation a grower could increase demand for cold pressed hemp oil, etc. **Partnering with existing Nevada businesses to fulfill their supply chain needs will be the most effective way to generate demand and cash flow.** Additionally, KMR is of the opinion that Nevada growers should examine establishing a branding campaign around Nevada Grown hemp to delineate and secure the concept of Nevada as a premium region. Any concerted effort to establish Humboldt County as a top-quality hemp producer will likely yield future pricing and demand benefits.

TECHNICAL ASSESMENT

Technical Assessment – KMR will review and summarize the current technical status of industrial hemp growing and processing focusing on the Great Basin. This work will include a summary of crop agronomics and yields, planting and harvesting equipment needs, and primary plant processing facilities. This assessment will provide recommendations for primary plant processing or separation of the whole plant into useable biproducts including fiber, hurd, and hemp seed oil. This assessment will not provide recommendations for secondary processing (fiber spinning and weaving, plastics manufacture, hempcrete, etc.). The technical assessment will develop a preliminary budget estimate for construction and equipping of a primary processing facility and a preliminary estimate for farm economics.

Hemp Planting

Our research and practical experience indicate that Humboldt County, Nevada is suitable for growing industrial hemp. The hemp plant is robust and cold tolerant and can thrive in alkaline or acidic soils. The hemp plant can reportedly thrive on as little as 12-inches of water per acre per year. This represents a savings of 33 percent over cotton's 18-inches of water per acre per year and alfalfa's estimated four-inches per cut ton (16-inches per acre). Our research indicates that fiber hemp has a much lower water demand than CBD hemp and a shorter growing window).

The fiber hemp plant doesn't require extensive fertilization and reportedly does best when the field is nutrient prepared prior to planting. A single application of nitrogen may be necessary during the growth cycle. The annual fertilizer requirements are below:

- 100-130 lb of nitrogen/acre
- 45-70 lb/acre phosphorus
- 35-80 lb/acre of potash

According to recent research at Penn State, planting for fiber hemp should be accomplished with a drill stand at a rate up to 50 pounds per acre with a target plant density of 15 plants per square foot. This high planting density is necessary to maintain uniform slim stocks and to prevent bifurcation and biomass accumulation along the stock. This helps prevent the need for herbicides as the hemp can naturally out-compete weeds at this density. A higher plant density creates more valuable fiber.

Plant maturity

Industrial hemp matures between 120-150 days for full, mature sexual reproduction and the development of mature seeds. Hemp grown for fiber can be harvested in as little as 60 to 80 days, or as soon as an appropriate stock diameter has developed. IH grown for

seed and oil is harvested before full seed maturity and at the peak of oil and nutrient development in the seed head. This could correspond to approximately 90-105 days. As most information and experience specific to Nevada's climate and growing conditions relates to growth of CBC hemp it is imperative that extensive study be performed regarding optimization of growing conditions, plant maturity, and harvesting to optimize productivity.

Harvesting

Harvesting of IH is notoriously troublesome. The plant is densely spaced and very fibrous. Standard equipment including swathers, haybines, and sickle mowers are reportedly ineffective for harvest as their blades are quick to dull and the hemp fiber causes tangling and fouling of the equipment. The New Holland Company has developed equipment they call a "discbine" that has shown promise in fiber hemp processing. This equipment uses a rotary disc cutter and is coupled with a crimper or "conditioner" that crimps the hemp stalk to promote drying.

In addition to New Holland, the John Deere Company has developed harvesting equipment specific to fiber hemp.

Hemp should be harvested approximately 6 inches above the ground to avoid cutting through the hard, woody stem portion of the plant.

Post-Harvest

Post-harvest management of fiber hemp depends on the ultimate destination of the fiber and the anticipated processing regime. Some operators will choose to "rett" the harvested hemp stalks prior to baling. Retting is a process that can be done wet or dry that encourages a breakdown of lignins within the hemp stalk and serves to expedite separation of fiber from hemp hurd. Historically, all fiber hemp was retted prior to further processing. Modern techniques and equipment may render the retting process unnecessary.

Windrows of hemp stalks can be made in preparation for baling as soon as the straw is sufficiently dry (12-16 %). Rotary rakes are recommended to form windrows of dry straw in preparation for baling. Wheel rakes frequently used for hay management may not perform well with hemp as the long and fibrous hemp stems may lead to equipment fouling. Depending on the processing plant equipment, round balers and large square balers could be used to package retted or un-retted material straw.

Decortication

After harvesting and retting, IH must be subjected to the process of decortication. In this process the raw hemp stalk is run through a purpose-built machine that separates the external bast fiber from the internal hurd. This is accomplished through a series of rollers and crimpers that provide stress to the hemp stalk and effectively break the hurd into small pieces. Many techniques for decortication are extant and several companies are now manufacturing modern equipment for decortication. Decortication equipment

will be the heart of a hemp fiber operation so much care should be taken in selection and maintenance of the equipment. Current producers of decortication equipment manufacture machines of all scales and of varying automation but most manufacturers are overseas companies. KMR was unable to locate an experienced domestic producer of decortication equipment during this study and anticipates that decortication equipment will likely be foreign bought and modified for local conditions. Hemp hurd is ready for further drying, screening, and packing immediately after the decortication process.

Degumming and Combing

Raw hemp fiber contains lignin compounds and must be de-gummed and combed prior to further use in the cordage or textile industries. The degumming process varies widely but essentially treats the hemp fiber with an alkaline solution or steam to dissolve lignin compounds and free them from the hemp fiber. Similar to decortication, KMR was unable to find a standard process or equipment manufacturer for degumming. The historic literature presents many variations of degumming techniques. Small-scale producers simple wash the fiber with soap and hot water to remove lignin. We would suspect that a system that subjects fiber to a high-pressure, high-temperature alkaline bath would be a likely candidate for production. Likewise it is anticipated that modern research into enzymatic degumming may yield suitable results. Research and development into degumming equipment and techniques is paramount for a successful fiber hemp operation. The degumming process could benefit from locally derived investment into research and development and represents an opportunity for investment for Humboldt County.

Hemp Seed Oil

A variety of equipment can harvest and sort hemp seed. Combines and other specialty equipment are currently used around the world to harvest, sort, and clean hemp seed prior to further processing. The process of extracting hemp seed oil from raw hemp grain involves use of a cold-expeller presses. These machines, although costly, are relatively simple to operate and utilize a screw pressing against a screen to squeeze out oil. These types of machines are readily available and are in use around the world. Hemp seed oil pressed for human consumption must be done so utilizing National Sanitation Foundation (NSF) certified equipment within an FDA inspected facility. Preservation and packaging must comply with FDA standards for sale into the food and cosmetics industry.

Hemp-seed oil processed without FDA oversight is suitable for sale as an industrial material and could find ready market penetration into the paint and biofuels industries.

Hemp Seed Meal

Hemp seed meal is a byproduct of oil extraction. After cold expeller pressing, the hemp seed hulls and meat are dried to between three and six percent moisture and then ground to an appropriate grain size. Standard equipment includes steel and stone burr

mills consistent with wheat milling. Hammer mills may also be utilized for grinding. Hemp seed can be packaged in bulk and sent to a wholesaler or packaged for individual sale.

Anticipated Costs

There are many, many variables to consider in developing preliminary costs for any industrial processing plant. Based on KMR's research we anticipate that a structure of a minimum 8,500 square would be required to construct a capable industrial hemp processing circuit. A facility must be capable of receiving and shipping industrial cargo and have a loading dock and forklift capability. Based on contractor interviews new construction of a suitable 8,500 square foot processing building would cost approximately $980,000.00. This cost estimate would include development of raw property within the City of Winnemucca in Humboldt County, Nevada. This rough cost estimate would include plan review and permitting fees and construction of a turn-key prefabricated steel structure including necessary freight handling facilities.

There is a wide range of equipment options that are available for decortication, degumming, and combing of hemp fiber. Additionally, there is a variety of options available for grain handling and expeller pressing of hemp seed oil and hemp seed meal. It is not practical to develop an accurate cost estimate for equipment and installation at this time. Based on our research and experiences with other industrial projects, KMR projects a budget amount between $1.25-$2.0M would be necessary to develop an automated system capable of processing 1000-2000 acres of industrial hemp into its saleable components (including building cost). At an estimated production rate of 4 tons per hour and 2,000 acres of growth, a system could produce upward of $825K in processing revenue annually. This value could be accomplished through continuous operation at an average equipment utilization rate of 56 percent (16 hours per day).

At the time of this writing we were able to procure two gross estimates of equipment costs. The first is a system produced by Colorado based Power Zone that touts a production rate of 10 dry tons per hour. This system is reportedly automated with a cost of $2M. It is our opinion that this system represents a high capital cost per processed ton. The second system is manufactured by a company called Formation Ag and is priced at $229K. This system is reportedly fully automated and can process approximately 1 ton of dry stem product per hour. The needs of a growing Nevada industry likely lie between the capabilities of these two examples. The process of decortication is simply and there is a likelihood that an effective machine circuit could be constructed locally for a reduced capital cost.

BARRIER ASSESSMENT

Barrier Assessment –To the best of our ability, we will identify and summarize potential barriers to market entry including technical, regulatory, and financial. KMR will review

and summarize the legal and regulatory status of industrial hemp agriculture and markets in Nevada. We will provide recommendations for mitigation of potential barriers.

The United States Department of Agriculture published the interim final rule for federal hemp production on Oct. 31, 2019 – nearly 11 months after passage of the 2018 Farm Bill made industrial hemp a federally legal crop to produce in the United States. The 2018 Farm Bill amends the Controlled Substances Act, 21 U.S.C. §801, et seq., removing Hemp from the term "marijuana". The term “Hemp” is defined in Farm Bill 2018 as the Cannabis sativa L. plant and any of its parts, including the seeds and all its derivatives, extracts, Cannabinoids, isomers, acids, salts, and salts of isomers, growing 10 or not, with a delta-9-tetrahydrocannabinol concentration not higher than 0.3% in its dry state.

Hemp is legal as long as it has a concentration of 0.3% THC in its dry state and complies with this law. In addition, Farm Bill 2018 stipulates that the Departments of Agriculture will have primary authority over the Hemp industry in their respective states and territories.

In order for a state or territory’s Department of Agriculture to obtain primary authority over the Hemp industry, it must submit to the USDA Secretary of Agriculture, through USDA-AMS, a State Plan in accordance to which the state or territory shall monitor and regulate that production. Nevada's Department of Agriculture is managing the 2020 industrial hemp crop under the 2014 Farm Bill pilot program. The NDA has drafted a Nevada Hemp Program State Plan that was submitted to the USDA for review. Per Senate Bill 347, the NDA is working under the 2018 Farm Bill regulations. After submitting the State Plan, the USDA will have sixty (60) days to approve, disapprove or request amendments to it.

A State Plan shall include practices for maintaining relevant information on the land on which Hemp is produced in the state or territory, including a legal tenure of the land, for a period of not less than three (3) calendar years. It shall also include a procedure for the test, using the post-decarboxylation method or other similar reliable methods, of the concentration levels of Hemp delta-9-tetrahydrocannabinol produced in the state or territory.

The NDA’s testing protocols reflect requirements set forth by the USDA. Currently, the NDA tests for total potential THC content less than 0.34% using High Performance Liquid Chromatography (HPLC) testing on all hemp varieties. All hemp produced in Nevada is subject to testing for compliance with federal law regardless of production intent.

Also, states must have a procedure for the effective elimination of products that are produced in violation of this law and a procedure to comply with the execution of this law must also be established. Also, it may include any other practice or procedure

established by a state to the extent that the practice or procedure is consistent with this law.

This regulatory framework presented in the interim rules, and which the Nevada Legislature mandated the NDA to follow, have been criticized by the hemp industry for creating barriers to growth.

These regulatory obstacles can be broken down as follows

- The department's insistence on only using labs registered with the DEA;
- The need for hemp producers to have a wider range of disposal options for non-compliant crops, such as feedstock, fuel or biochar;
- The requirement that growers test hemp plants within 15 days of anticipated harvest (The industry foresees difficulty in accomplishing the testing in such a time frame due to the state's lack of resources and the short time frame does not take into account the wide variety of seed genetics that show varying harvest schedules
- The inflexible testing requirement for total delta-9 tetrahydrocannabinol (THC), levels and test the entire plant, not just the top few inches.
- Increase the negligent threshold from 0.5% to 1% total THC in order to provide a safe environment for first-time and veteran farmers who would otherwise face criminal sanctions. This would also align with European hemp rules.
- Create a processes of hemp testing for under 1% total THC to go to processors that will ensure the product is compliant and can then flow into normal commerce channels.

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