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regarding whether or not WEL-Life and Lantis were engaged in a joint venture or enterprise, although three of the four elements of joint enterprise should have been determined to have been established as a matter of law. Therefore, the issue of control should have proceeded to trial to be decided by a jury.

We further find that the Estate was prejudiced by the decision on summary judgment and by the jury instructions given at trial, because, despite having found via summary judgment that WEL-Life and Lantis were not engaged in a joint venture, the district court instructed the jury that if it found in favor of WEL-Life, then it must also find in favor of Lantis—thereby linking the fates of the two companies. Clearly, this was prejudicial to the Estate, because the jury was not allowed to find that only Lantis was liable, bearing in mind that there was evidence from which a jury could find by reasonable inference that Lantis had not properly carried out its oversight duties with respect to WEL-Life's operations. We therefore reverse, and remand the matter for a new trial.

REVERSED AND REMANDED FOR A NEW TRIAL.

DONALD LEE OPPLIGER AND JOI MICHELE OPPLIGER, HUSBAND AND WIFE, APPELLEES, V. BRIAN J. VINEYARD AND JANET K. VINEYARD, HUSBAND AND WIFE, APPELLANTS.

803 N.W.2d 786

Filed September 20, 2011. No. A-10-712.

1. **Appeal and Error.** An appellate court considers only those assignments of error which are both specifically assigned and specifically argued.
2. **Equity: Boundaries: Appeal and Error.** An action to ascertain and permanently establish corners and boundaries of land under Neb. Rev. Stat. § 34-301 (Reissue 2008) is an equity action.
3. **Equity: Appeal and Error.** In an equity action, an appellate court reviews the record de novo and reaches an independent conclusion without reference to the conclusion reached by the trial court, except that where credible evidence is in conflict, the appellate court will give weight to the fact that the trial court saw the witnesses and observed their demeanor while testifying.

4. **Actions: Equity: Boundaries: Appeal and Error.** When one or more owners of land, the corners and boundaries of which are in dispute, desire to have the same established, they may bring an action in the district court of the county where such land is situated, against the owners of the other tracts which will be affected by the determination or establishment thereof, to have such corners or boundaries ascertained and permanently established, which issue shall be tried before the district court under its equity jurisdiction without the intervention of a jury, and appeals from such proceedings shall be had and taken in conformity with the equity rules.
5. **Waters: Boundaries: Easements.** Subject to the easement of navigation, riparian owners are entitled to the possession and ownership of an island formerly under waters of the stream as far as the thread of the stream.
6. **Real Estate: Waters: Boundaries: Words and Phrases.** The thread of the stream is the deepest groove or trench in the bed of a river channel, the last part of the bed to run dry, and where the thread of a stream is the boundary between estates and that stream has two channels, the thread of the main channel is the boundary between the estates.
7. **Real Estate: Waters: Words and Phrases.** Avulsion is a sudden and perceptible loss of or addition to land by the action of water, or a sudden change in the bed or course of a stream.
8. **Waters: Words and Phrases.** Avulsion is a change in a stream that is violent and visible and arises from a known cause, such as a freshet or a cut through which a new channel has formed.
9. **Real Estate: Waters: Words and Phrases.** Accretion is the process of gradual and imperceptible addition of solid material, called alluvion, thus extending the shoreline out by deposits made by contiguous water; reliction is the gradual withdrawal of the water from the land by the lowering of its surface level from any cause.
10. **Real Estate: Waters: Boundaries.** The changes wrought by accretion versus avulsion involve markedly different processes, and each process has a different consequence for the boundary between the landowners on opposite banks of the river.
11. **Boundaries: Time.** Nebraska law provides that boundaries that have been mutually recognized and acquiesced in for a period of 10 years can be legal boundaries.
12. **Boundaries.** In order to claim a boundary line by acquiescence, both parties must have knowledge of the existence of a line as the boundary, and therefore, the mere establishing of a line by one party and the taking by that party of possession up to that line are insufficient.
13. **Waters: Boundaries.** The mean centerline of a river, determined by dividing the distance between meander lines of the river, is an arbitrary location of the center of the stream and is not a determination of the thread of the stream in this jurisdiction.

Appeal from the District Court for Lincoln County: DONALD E. ROWLANDS, Judge. Reversed.

Allen L. Fugate for appellants.

Stephen D. Mossman, of Mattson, Ricketts, Davies, Stewart & Calkins, for appellees.

INBODY, Chief Judge, and SIEVERS, Judge.

SIEVERS, Judge.

I. INTRODUCTION

This action is a boundary dispute concerning accretion land of the North Platte River in Lincoln County, Nebraska, which began with the filing of a complaint seeking to establish corners and boundaries of property in dispute pursuant to Neb. Rev. Stat. § 34-301 (Reissue 2008). While a number of other landowners were originally parties to the litigation, in this appeal, only Donald Lee Oppliger and Joi Michele Oppliger, who were among the plaintiffs, and Brian J. Vineyard and Janet K. Vineyard, who were among the defendants, are now involved. The Oppligers own land located on the north side of the North Platte River, "Section 9, with all accretions thereto, all in Township 14 North, Range 34 West of the 6th P.M." in Lincoln County. The Vineyards, as of the time of trial, own only accretion land in section 16 located directly to the south of the Oppligers' land on the south side of the North Platte River. The litigation and appeal involve where the boundary between these two properties is located and, consequently, who owns what accretion land adjacent to the river.

The matter consumed over 5 days of trial to the court, producing a more than 1,200-page trial record and well over 100 exhibits. On April 23, 2010, the district court entered its decision, concluding that it was impossible at that point in time to determine the thread of the North Platte River other than to conclude that the geographic centerline thereof as depicted in the Government Land Office (GLO) survey filed May 24, 1870, establishes the boundary between the north-bank and south-bank land. Additionally, the trial court rejected the Vineyards' claims of adverse possession as well as the Vineyards' alternative claim that a fence line established the boundary. We find that the thread of the stream can be located

and that it is in the north channel of the North Platte River. Thus, we reverse.

II. DISPUTED LAND

The original numerous parties to this lawsuit all owned land adjacent to the North Platte River, generally to the east of the lands owned by the Oppligers and the Vineyards. On the north side of the river, those parties were Joseph V. Herrod and Janice M. Herrod. On the south side of the river, those parties were Chester T. Binegar and Wanda L. Binegar, Harley C. Gries and Nona Jean Gries, and Steven W. Binegar. The north-bank land had previously been owned by Bar B Cattle Company, a Nebraska corporation. On March 8, 2007, Bar B Cattle Company was conveyed to Osborne Cattle Company, L.L.C., a Nebraska limited liability corporation. Thereafter, section 9 was conveyed by Osborne Cattle Company to the Oppligers.

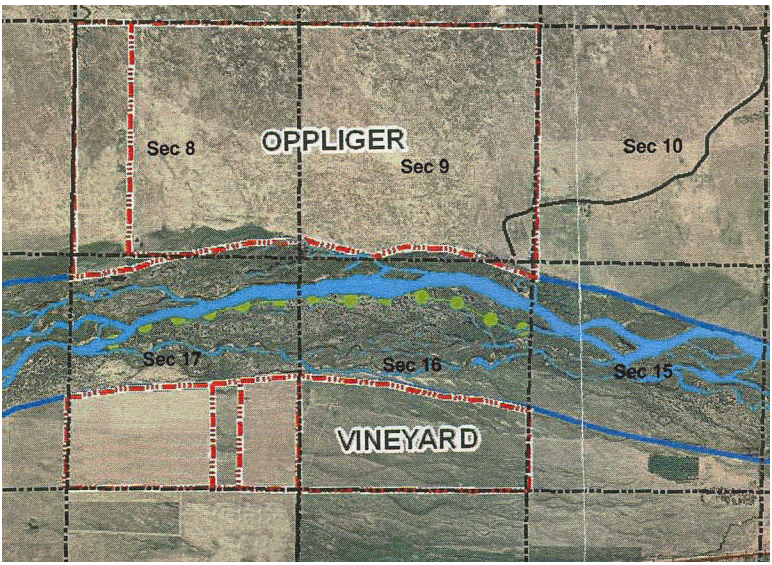
As set forth by the district court, the Vineyards are the record owners of

> [g]overnment Lots 2, 3, 4, and 5 and the South half of the South half of Section 16, Township 14 N[orth], Range 34 West of the 6th P.M. in Lincoln County, Nebraska and all accretions thereto except parts conveyed in two warranty deeds and one quitclaim deed shown in [the trial record].

(Emphasis omitted.) This south-bank land involves legal descriptions in extensive and complicated metes and bounds descriptions that we need not set forth. The Oppligers are the record owners of "[t]he North half of the North half of Section 16, and the North half of the North half of Section 17, with all accretions thereto," and "the East half of the West half and the East half of Section 8, and all of Section 9, with all accretions thereto," "all in Township 14 North, Range 34 West of the 6th P.M. in Lincoln County, Nebraska." (Emphasis omitted.) The Oppligers claim ownership of all of the accretion ground to the thread of the south channel of the North Platte River—which they claim is the thread of the stream of the North Platte River.

Conversely, the Vineyards claim ownership of the accretion ground to the center of the north channel of the North Platte River—which they contend is the thread of the stream of the North Platte River. Additionally, the Vineyards assert, apparently as a "back-up position," that the boundary is the "existing fence located along the south side of the north channel of the North Platte River." This fence was surveyed, legally described by metes and bounds, and platted during the course of this litigation by a surveyor, Bonita Edwards.

As an aid to the reader, we have reproduced a portion of a 2006 aerial photograph of the land, received in evidence by the district court. The area involved is frequently called the project reach, and we shall use that term. The 2006 aerial photograph has superimposed on it the meander lines of the North Platte River from the 1870 GLO survey, indicated by dark blue lines. The land originally owned by the Vineyards is designated with their name and red-and-white borders, although by the time of trial, the Vineyards had conveyed away all of such land except what they might own of the accretion lands located north of the northern boundary of what is designated as "VINEYARD"



within certain of the red-and-white borders in the photograph. The Oppligers' land, as well as that of former parties to the litigation, is also outlined in the red-and-white borders. The various channels of the river are discernible. Shown as green dots is the fence line that was surveyed and platted by Edwards, as detailed hereafter, which we call the north fence.

III. DISTRICT COURT DECISION

In its decision of April 23, 2010, the district court for Lincoln County noted the Nebraska Supreme Court's decision in *Anderson v. Cumpston*, 258 Neb. 891, 606 N.W.2d 817 (2000), which the trial court described as a similar boundary line dispute located in Dawson County, Nebraska, and which happened to have been tried before the same trial judge as in this case. The trial judge noted that in *Anderson*, he found it was impossible to ascertain the location of the current thread of the Platte River because of the construction of a series of bridges across the Platte River and because the flow had also been affected by the construction of Kingsley Dam, which created Lake McConaughy. On appeal, the Supreme Court in *Anderson* noted that there was no evidence that either channel of the river had ever completely dried up. The trial judge here noted that the Supreme Court in *Anderson* agreed with the establishment of the boundary at the geographic centerline of the Platte River as measured by an 1869 U.S. government survey, although for reasons different from the trial judge's. We shall discuss *Anderson* in more detail later.

The trial court in the case before us then noted that to the west of the Sarben Bridge, there is one main channel of the North Platte River, but that approximately one-quarter mile east of such bridge, the North Platte River splits into two channels, described as the north and south channels, that flow through the project reach. The court noted that a relatively short distance east of the disputed accretion ground, the two channels merge again into one channel. The trial court found that neither the north channel nor the south channel has ever dried up and that "[n]o credible evidence was introduced to prove which channel will completely dry up in times of severe drought." The court then found:

> In my opinion, the construction of Kingsley Dam which totally obstructed the flow of the North Platte River by creating Lake McConaughy, as well as the construction of the Sarben Bridge[,] caused the North Platte River to bifurcate west of the disputed accretion ground and to form two separate and distinct channels. It is impossible at this point in time to determine the thread of the North Platte River other than to conclude that the geographical centerline thereof as measured by the [GLO] Survey . . . filed May 24, 1870 . . . established the boundary line between the lands owned by the respective Plaintiffs and the respective Defendants.

The trial judge said that he rejected the testimony of the Vineyards' expert, Dr. Michael D. Harvey, that the construction of the Sarben Bridge did not cause the bifurcation. He likewise rejected Harvey's opinion that the construction of Kingsley Dam in 1941 changed the amount of flow but not the location of the main channel of the North Platte River. The trial court accepted and adopted the opinion of the Oppligers' expert, Mark Mainelli, that it is "reasonable [to] assume" that the thread of the main channel of the North Platte River in 1870 was at or near the geographic centerline of the river. The trial court then found that any change in the original location of the main channel of the North Platte River after the 1870 GLO survey was caused by avulsive events including but not limited to construction of the Sarben Bridge and Kingsley Dam, floods in 1971 and 1973, and artificial flows from Kingsley Dam for irrigation purposes and generation of hydroelectric power.

Further, the court rejected each party's claimed ownership by virtue of adverse possession, finding that the accretion ground is used primarily for hunting and recreational purposes, although it can be used to pasture cattle and horses, but was not continuously used for such purposes during the statutory period required to prove adverse possession. The court concluded that neither party could establish exclusive use, for the requisite 10-year timeframe, of the accretion ground which they were claiming. Finally, the court accepted the testimony

of the president of Bar B Cattle Company that the north fence, surveyed and legally described by Edwards, was never intended to define the boundary lines between the landowners' properties to the north and to the south of the North Platte River in the project reach.

Therefore, the court found that "[t]he boundary line between the accretion ground adjacent to each party's deeded real estate is fixed and determined to be the geographical centerline of the North Platte River as measured from the original meander line[s] of the North Platte River according to the [GLO] Survey filed May 24, 1870 . . . ." The Vineyards have perfected this timely appeal.

IV. ASSIGNMENTS OF ERROR

[1] Because of the extensive number of assignments of error asserted by the Vineyards, we have very carefully compared the alleged assignments of error with the arguments asserted by the Vineyards in their brief, given the well-known rule that an appellate court considers only those assignments of error which are both specifically assigned and specifically argued. See *In re Interest of Hope L. et al.*, 278 Neb. 869, 775 N.W.2d 384 (2009). Therefore, rather than setting forth all of the assignments of error, we list only the assignments of error for which there is a corresponding argument made in the appellants' brief. Those assignments of error, renumbered, are as follows: (1) The district court erred in considering evidence outside the record, (2) the district court erred by abdicating its gatekeeping responsibility with respect to expert witnesses and relying upon expert opinion that was incompetent under Neb. Rev. Stat. § 27-702 (Reissue 2008), (3) the district court erred in admitting the expert opinion of Mainelli, (4) the district court erred in admitting certain photographs, and (5) the district court erred in admitting Mainelli's testimony concerning a formula used in hydraulic studies and admitting a chart generated by Mainelli.

It is clear that the other nine assignments of error can be reduced to the assertion that the district court erred in establishing the boundary between the lands of the Vineyards and

the Oppligers at the geographic centerline of the North Platte River meander lines as measured by the 1870 GLO survey. There is no cross-appeal.

V. STANDARD OF REVIEW

[2,3] An action to ascertain and permanently establish corners and boundaries of land under § 34-301 is an equity action. *Anderson v. Cumpston*, 258 Neb. 891, 606 N.W.2d 817 (2000); *Babel v. Schmidt*, 17 Neb. App. 400, 765 N.W.2d 227 (2009). In an equity action, an appellate court reviews the record de novo and reaches an independent conclusion without reference to the conclusion reached by the trial court, except that where credible evidence is in conflict, the appellate court will give weight to the fact that the trial court saw the witnesses and observed their demeanor while testifying. See *Sila v. Saunders*, 274 Neb. 809, 743 N.W.2d 641 (2008).

VI. ANALYSIS

1. Applicable Water Law

We believe that before detailing additional evidence, we should first put in place some basic principles of water law that have been well established by the Nebraska appellate courts. This is particularly true given the size and complexity of the trial record. The record contains aerial photographs taken of the North Platte River at various times—beginning in 1938 and up to 2006, as well as various rectified overlaid images derived therefrom. There are numerous surveys, beginning with the 1870 GLO survey; data compilations by the experts; many photographs; and various documents evidencing transactions in the project reach. In short, the evidence is not easily reduced to a concise narrative. That being said, at least the central issue can be simply stated: Where is the boundary in the area where the North Platte River flows between the properties owned by the Oppligers and the Vineyards? The answer, and thus the evidence, is complicated by the fact that in the project reach, the North Platte River is bifurcated into a north channel and a south channel.

[4] Section 34-301 is the statute under which this action is brought, and it provides in pertinent part:

> When one or more owners of land, the corners and boundaries of which are . . . in dispute, desire to have the same established, they may bring an action in the district court of the county where such [land is] situated, against the owners of the other tracts which will be affected by the determination or establishment thereof, to have such corners or boundaries ascertained and permanently established. . . . Either the plaintiff or defendant may, by proper plea, put in issue the fact that certain alleged boundaries or corners are the true ones, or that such have been recognized and acquiesced in by the parties or their grantors for a period of ten consecutive years, which issue shall be tried before the district court under its equity jurisdiction without the intervention of a jury, and appeals from such proceedings shall be had and taken in conformity with the equity rules.

[5,6] Subject to the easement of navigation, riparian owners are entitled to the possession and ownership of an island formerly under waters of the stream as far as the thread of the stream. *Summerville v. Scotts Bluff County*, 182 Neb. 311, 154 N.W.2d 517 (1967). The thread or center of a channel is the line which would give the owners on either side access to the water, whatever its stage might be, and particularly at its lowest flow. *State v. Ecklund*, 147 Neb. 508, 23 N.W.2d 782 (1946). In other words, the thread of the stream is the deepest groove or trench in the bed of a river channel, the last part of the bed to run dry, and where the thread of a stream is the boundary between estates and that stream has two channels, the thread of the main channel is the boundary between the estates. *Monument Farms, Inc. v. Daggett*, 2 Neb. App. 988, 520 N.W.2d 556 (1994). See *Hardt v. Orr*, 142 Neb. 460, 6 N.W.2d 589 (1942). However, it is well known that the course of rivers and streams can change by avulsion or accretion.

[7-10] Avulsion is a sudden and perceptible loss of or addition to land by the action of water, or a sudden change in the bed or course of a stream. *Monument Farms, Inc. v. Daggett, supra*. Avulsion is a change in a stream that is violent and visible and arises from a known cause, such as a freshet or a cut through which a new channel has formed. See *Conkey v.*

Knudsen, 141 Neb. 517, 4 N.W.2d 290 (1942), *vacated on other grounds* 143 Neb. 5, 8 N.W.2d 538 (1943). On the other hand, accretion is the process of gradual and imperceptible addition of solid material, called alluvion, thus extending the shoreline out by deposits made by contiguous water; reliction is the gradual withdrawal of the water from the land by the lowering of its surface level from any cause. *Monument Farms, Inc. v. Daggett, supra.* The changes wrought by accretion versus avulsion involve markedly different processes, and each process has a different consequence for the boundary between the landowners on opposite banks of the river. *Babel v. Schmidt*, 17 Neb. App. 400, 765 N.W.2d 227 (2009). See *Monument Farms, Inc. v. Daggett, supra.*

In *Babel v. Schmidt*, 17 Neb. App. at 407-08, 765 N.W.2d at 234, we discussed avulsion and accretion at some length:

> A party who seeks to have title in real estate quieted in him on the ground that it is accretion to land to which he has title has the burden of proving the accretion by a preponderance of the evidence. *State v. Matzen*, 197 Neb. 592, 250 N.W.2d 232 (1977). The burden to show that the channel of the river changed by avulsion obviously would be the same. [The plaintiff] argues that there is a presumption of accretion if avulsion is not shown. However, we disagree that such presumption exists under Nebraska law and find the reasoning of *United States v. Wilson*, 433 F. Supp. 57 (N.D. Iowa 1977), on this point persuasive where the court applied Nebraska law to land altered by the changing course of the Missouri River.
>
> Past cases have illustrated the sorts of events that constitute avulsion. See, *Anderson v. Cumpston, supra* (party admitted that change in thread of Platte River was brought about suddenly by artificial structures and diversion, thus doctrine of avulsion applied and boundary remained in center of old channel); *Ziemba v. Zeller*[, 165 Neb. 419, 86 N.W.2d 190 (1957)] (based on photographs and eyewitness reports, construction of diversion dam and riprapped dike some 700 to 800 feet long, which shut off main channel, constituted avulsion); *Ingraham v. Hunt*, 159 Neb. 725, 68 N.W.2d 344 (1955) (flash floods that

suddenly, violently, and visibly moved channel of river far toward north of original channel can be considered avulsion); *Conkey v. Knudsen, supra* (evidence was sufficient to show ice gorge created by spring floods in 1910 altered course of Missouri River and constituted avulsion, not accretion).

2. Expert Testimony—Where Is Thread of Stream?

(a) Oppligers' Expert—Mainelli

The Oppligers' expert was Mainelli, a consulting engineer operating his own civil engineering firm located in Lincoln, Nebraska. Mainelli obtained a bachelor of science degree in civil engineering from the University of Nebraska at Omaha in 1986 and is licensed as an engineer in Nebraska and Iowa. After college, Mainelli worked for Nebraska's Department of Roads in Columbus, Nebraska, and then Norfolk, Nebraska, for about 3 years. He then came to the Department of Roads' bridge unit in Lincoln. His principal work there was appraising the status of bridges in the state with respect to their condition, including structural or environmental situation, as well as with respect to "scour." Scour relates to the degradation, aggregation, or contraction that occurs in riverbanks and riverbeds as a result of the flow of water, particularly around obstacles such as bridges. After his time with the Department of Roads, Mainelli worked for an engineering firm in Lincoln from 1992 to 2001. He testified that the primary function of that business was to study river hydraulics and do structural river environment work. In 2001, Mainelli formed his own civil engineering company, continuing to work on bridges and river environments and doing hydraulic studies relating to rivers and flood plains. Mainelli is also a Nebraska-licensed Class A highway superintendent, and he has worked for some of the smaller counties in the state that did not have a person in that position.

Mainelli was retained by the plaintiffs, all of whom have resolved their claims except the Oppligers, to "formulate an opinion on where [he] felt the thread of the stream was in this [project reach]." He defined the thread as being the last part of the stream to dry up. The North Platte River in the project

reach comprises a north channel and a south channel by virtue of a bifurcation in the river approximately 1½ miles east of the Sarben Bridge. That bifurcation extends through the project reach, and then the two channels join several miles east of the project reach. The project reach is located approximately halfway between the bifurcation and the confluence of the north and south channels of the North Platte River.

The first time Mainelli inspected the project reach was on May 2 and 3, 2007. At that time, Mainelli and his survey party chief walked both channels north to south as well as east to west. They collected data in order to construct three cross sections of what Mainelli described as "typical channels at the edges of the properties." The locations of these three cross sections were the west Herrod property line, the east Herrod property line, and the east Oppliger property line, as such lines crossed the north and south channels of the North Platte River.

To construct and ultimately graph these cross sections, Mainelli took a series of measurements using a global positioning system (GPS) mounted on top of a rod which had a 1-foot by 1-foot plate welded to the bottom of it. The purpose of the plate was to ensure that when the rod was set on the river floor, it was not pushed deeper into the riverbed. Reduced to the simplest explanation, the cross sections of the north and south channels were produced by taking GPS readings of elevations at the top of the riverbank, at the water's edge, and at the flow line (i.e., top surface) of the river. Mainelli made it clear that the purpose was not to "compare elevations [of the earth]" but to "look[] for . . . the depth of [the channels]." Mainelli testified that the method he employed is the generally accepted method of cross sectioning of rivers in Nebraska. Once the field data is gathered, it is placed on grid paper where points are plotted and connected, which produces, in Mainelli's words, a view of the river as "if you took a slice of pie and lifted it up and looked at the cross section of it."

Mainelli testified that he made a second visit to the project reach in April 2008, explaining that he wanted to examine the river earlier in the spring, prior to "green-up." On this occasion, GPS data was not collected, but, rather, the channels

were walked in approximately the same locations as the previous May and photographs were taken of a person standing in the channels at the general locations where the cross sections were measured the previous May in order to show approximate water depth at the time of Mainelli's second visit.

Mainelli was asked to render his opinion with a reasonable degree of certainty in the field of hydrology and hydraulics "as to which channel the thread of the stream is located [in]." His opinion was that it was located in the south channel, which he described as the last place to dry up. He explained that he arrived at that conclusion by taking from the cross sections the algebraic difference between the high flow and the low flow in each channel. He testified that at his first data point, the water in the south channel, when compared to that of the north channel, is about a foot deeper; that at the second data point, it is at least one-half foot deeper; and that at the third data point, it is 1½ feet deeper. The result of these algebraic comparisons was supported, in his opinion, by his "eyeball observation" of the two channels in May 2007 and April 2008, in that "when you walk into that north channel on that west boundary of the Herrod property and get into that south channel, there is no question of where the majority of the flow is and the depth of the flow." Thus, he opined, the thread of the North Platte River is in the south channel in the project reach.

(b) Mainelli's Rebuttal Testimony

For continuity, we turn to Mainelli's rebuttal testimony, although such occurred after the testimony of the Vineyards' expert, Harvey—whose testimony we shall shortly detail. Mainelli testified that he had reviewed Harvey's report, which was critical of Mainelli's conclusions. As a result, Mainelli used "the Manning formula" as an alternate method to determine the thread of the North Platte River, which formula he described as "a relationship between area of wetted perimeter, velocity and flow rates" that was developed in the 1800's by a man named "Manning" and is a commonly used tool in hydraulic studies. The Manning formula uses the slope of the water as it flows downstream, which typically parallels the slope of the adjacent flood plain. Mainelli testified that

he has previously used the Manning formula and that it is a standard engineering practice used in almost every hydraulic study. Mainelli testified that the use of the Manning formula revealed that the south channel had significantly more flow than the north channel, whose flow rate he described as 17 cubic feet per second (cfs), whereas the south channel's flow rate was "in the neighborhood of . . . mid-70 cfs." According to Mainelli's testimony on rebuttal, the use of the Manning formula confirmed his previously testified opinion that the thread of the stream of the North Platte River in the project reach was located in the south channel. Mainelli indicated that his criticism of Harvey's analysis was that Harvey had used high riverflows rather than low riverflows, the latter of which Mainelli used to arrive at his conclusion that the thread of the stream was in the south channel.

After cross-examination, the court asked whether Mainelli had an opinion to a reasonable degree of certainty in his field of expertise as to whether in 1870, at the time of the original GLO survey, the geographic centerline between the original meander lines was at or near the center of the stream, to which question counsel for the Vineyards objected "as to foundation; lack of personal knowledge, [§] 27-702." The objection was overruled, and the court granted a continuing objection to the two additional questions from the court which we recount below. To the question above, Mainelli responded, "Without any additional information and [with] the lack of detail, that would be a reasonable assumption." The court also asked Mainelli whether he had an opinion as to whether the construction of the Sarben Bridge caused the bifurcation of the North Platte River into the two channels involved in the project reach. Mainelli responded: "I can't say positively that it caused the bifurcation, but I will tell you that constrictions in the floodplain do impact the downstream and the upstream conditions of the river." Finally, in response to the court's next question, Mainelli said he had no opinion on whether the construction of Kingsley Dam in 1941 was an avulsive event which caused the channel of the North Platte River to change.

(c) Vineyards' Expert—Harvey

Harvey, of Fort Collins, Colorado, testified at length on behalf of the Vineyards. At the time of his testimony, Harvey was the program manager for both the geomorphology section and the surface water group of a corporation with which his previous employer, an engineering firm, had recently merged. Harvey received his bachelor's degree in 1969 from the University of Canterbury, New Zealand, in soil and water engineering; a master's degree from the same institution in 1973 in soils and hydrology; and a Ph.D. from Colorado State University in 1980 in fluvial geomorphology. He explained that "fluvial geomorphology" comes from the Greek terms "[g]eo," meaning earth; "morphe," meaning shape; and "ology," meaning study, and from the Latin word "fluvial," meaning of rivers. Thus, Harvey explained, a fluvial geomorphologist works on river dynamics and processes, i.e., how rivers move, change, and behave. When Harvey completed his Ph.D., he began working for Colorado State University on research projects dealing with rivers all over the United States as well as several international projects. From 1983 to 1988, he was a senior research scientist and associate professor of geology at Colorado State University. In that capacity, his work involved teaching graduate-level courses in geomorphology, hydrology, hydraulics, and river mechanics. In 1988, Harvey left Colorado State University. Since then, he has worked for several companies doing "hydrology, hydraulics, sediment transport, modeling river analysis, [and] geomorphic studies of rivers" throughout the United States.

Harvey was hired by the Vineyards, in his words, "to identify the location of the main channel and hence the thread of the [North Platte R]iver through time" and "to determine whether the thread of the river has moved to its current location as a result of the gradual process of accretion or as a result of sudden change by avulsion." According to Harvey, the thread of the stream is "the deepest portion of the cross section or the lowest elevation." He defined accretion as the process of continuing slow migration or adjustment of a river, whereas avulsion is a sudden change of the location of the river over a very short period of time. Harvey defined the project reach as

being from the Sarben Bridge on the west to the confluence of the north and south channels to the east.

In connection with his analysis of the project reach, Harvey was provided with a copy of the original 1870 GLO survey as well as aerial photographs of the North Platte River taken at the project reach for the first time in 1938 and then again in 1958, 1965, 1970, 1971, 1978, 1985, 1999, and 2006—all of which were taken in the spring or summer, when "green-up" had occurred and the river was flowing freely. Additionally, Harvey examined three primary publications about the river's history written in 1977, 1978, and 1983, which he recognized as authoritative, and we note no challenge was made to his reliance thereupon. He testified, without objection, that in the 1860's, the North Platte River was a "braided river system [and the] change [to the river] is the result primarily of large flood flows" that he said were avulsive events. The term "braided river system" clearly implies the existence of more than one channel. By way of context, Harvey testified that the peak flows in the North Platte River were approximately 25,000 cfs between 1909 and 1927. Thereafter, dams were built upstream on the North Platte River northwest of the project reach, and the average peak flow ultimately dropped to approximately 2,400 cfs. Harvey testified that the North Platte River, which was roughly 2,500 feet wide at the time of the original GLO survey, had shrunk to approximately 290 feet in width by 1965. Harvey testified that this reduction in flow and width promoted the growth of riparian vegetation which provided resistance to the channel banks that had not previously existed. Harvey's testimony was that the North Platte River changed from being a "multi-channeled, multi-sandbar braided" river in the 1860's as the impact of flow reduction took place and vegetation developed so as to form a stable "anastomose river planform" where there might be coexisting channels that are separated by essentially stable flood plain elements with anastomose channels. We understand anastomose river or streams to consist of multiple channels that divide and reconnect and are separated by such cohesive material that they would likely not be able to migrate from one channel position to another. Regarding such a system,

Harvey testified that the "primary mode of change is nonprogressive[,] . . . avulsive," and that such avulsive change occurs during infrequent, large flood events.

Harvey used the aerial photographs, the 1870 GLO survey map, and a U.S. Department of Agriculture quadrangle map in a process whereby various reference points on the sequential aerial photographs were georeferenced and then, through a computer program (which we will not try to explain), the images were rectified with one another as to size and location. Through this process, a reproduction of a single aerial photograph of the project reach was produced with the locations of channel flow from the sequential aerial photographs being placed thereupon in different colors. This produced images of the changes in the river's channels from 1938 to 2006 all within the 1870 GLO survey meander lines in the project reach. From such exhibit, it is clear that since at least 1938, the river has been channelized in the project reach. Additionally, on that exhibit, the "north fence" (to be discussed shortly in more detail), as surveyed and platted by Edwards, is shown as a series of green dots.

Harvey also examined data from two flow gauges located downstream of Kingsley Dam—at Keystone, Nebraska, and Sutherland, Nebraska—the latter being approximately 5 miles downstream of the project reach. This flow data revealed that since Kingsley Dam was built in 1941, peak flows have generally been around 4,000 cfs. The evidence shows that a cubic foot of water contains approximately 7½ gallons. Using the records of the flows at such gauges, Harvey identified certain times of high flow as follows: Harvey testified that in 1971, the peak flow of the North Platte River going by the Sutherland gauge was 9,090 cfs or 68,175 gallons per second, or approximately 4.1 million gallons per minute. Harvey identified another instance of peak flow in 1973, at 7,620 cfs, and elsewhere in his testimony, Harvey referred to these high flows in the 1970's as "floodflows." Harvey also identified other times of peak flow in 1983 of 6,540 cfs; another in 1984 of 6,390 cfs; and another in 1994 of 5,230 cfs. These flows were all measured at the Sutherland gauge. When Harvey was at the project reach on September 9, 2009, the flow at the Sutherland

gauge was 194 cfs, which provides us with some context with reference to the floodflows.

Harvey began his field investigation at the Sarben Bridge because he knew at that location the entire flow of the North Platte River was in a single channel. Harvey walked and waded in the channels at the point of bifurcation, looking for a number of things such as a rough estimate of how the flow was splitting into the north and south channels—his estimate was roughly 50-50. Harvey also wanted to examine the vegetation that has grown in the North Platte River since the dams were erected. According to Harvey's testimony, the significance of vegetation is that it binds soil particles and enables the banks of the channel to become more or less fixed and erosion resistant, whereas historically, before the dams, they were not. Harvey testified that at one location, he found a "cut-across channel" where there was flow from the south channel to the north channel. His opinion as to the amount of that flow, based on measurement of the depth and width of the cut-across channel plus his estimate of the rate of flow, was 18 cfs or 8,100 gallons per minute.

Harvey then moved downstream in the north channel of the North Platte River to the point where East Clear Creek feeds into that channel. He estimated a flow from East Clear Creek into the north channel at 5 to 7 cfs or 2,250 to 3,150 gallons per minute.

Using the 1970 aerial photograph, Harvey opined that the thread of the stream of the North Platte River in sections 16 and 17 was somewhere in the main channel, which was located north of the north fence, and that there was no channel south of the north fence line at that time in section 17. Thus, according to Harvey, there simply was not a south channel in the project reach in 1970. He noted that to the east of the project reach, there was a small channel or braid that came from the north down to the south, but by the time of his fieldwork in September 2009, that braid was one of the abandoned or "relic" channel segments that he encountered during the field inspection. He observed that these relic channels contain standing water rather than flowing water even at times of high flow, in effect forming ponds or small lakes.

With reference to the 1974 aerial photograph, Harvey's opinion was that the north channel was still the main channel, but that by then, a channel had opened up to the south of the north fence. His opinion was that the thread of the stream would have been located within the north channel in 1974. It is worth noting that Harvey was asked whether the flow data for the North Platte River as measured at the Sutherland gauge correlated with his opinions using the 1970 and 1974 aerial photographs. Harvey responded:

> The presence of the formation of a channel south of the [north] fenceline between 1970 and 1974 coincides with the period where there were high flows on the North Platte River, flood flows. And in the early '70s and in an anastomose river system, high flows are most likely to cause an avulsion. And that south channel is avulsive, it's not progressive.

Harvey's testimony was that he held the same opinions with respect to the location of the dominant channel and the thread of the stream when looking at the 1978 aerial photograph: that they had been in the north channel. Harvey testified that the north channel remained the main or dominant channel, and the site of the thread of the stream, in regard to the 1985, the 1999, and the 2006 aerial photographs. Harvey noted that the peak flow data earlier referenced from 1983 and 1984 was reflected in the fact that the south channel had increased in width in the 1985 aerial photograph, although it was still not the main or dominant channel.

Harvey next testified about his use of "basic hydraulic geometry equations" that are found in Luna B. Leopold & Thomas Maddock, Jr., Dept. of Interior, The Hydraulic Geometry of Stream Channels and Some Physiographic Implications, U.S. Geological Survey Professional Paper 252 (1953). We will not try to "do or explain the math" of such equations other than to describe them as formulas that use the amount of flow and the width of the channel, given that there is an established and recognized proportional relation between the two. Harvey testified about those equations: "[T]he wider the channel is, effectively, the more flow it is, the more flow it conveys and, therefore, the more dominant a channel it is." Harvey's bottom-line opinion

was that the data and the math show that between 1938 and 2006, the bulk of the flow in the wetted channel area was to the north of the north fence, and that in fact, between 1938 and 1958, the south channel was pretty much closed off. While Harvey admitted that the south channel got larger in the 1970's because of high flows, he determined that the bulk of the wetted area was still to the north of the north fence line and has been that way ever since, as shown on the aerial photographs since the first such photograph in 1938. In summary, Harvey's opinion was that the thread of the North Platte River is located in the north channel.

Harvey testified that in forming his opinions as to the thread of the stream's being located in the north channel, he employed the following 10-step methodology:

- Identify the project reach.
- Obtain the background information on the geomorphology and dynamics of the river within the project reach.
- Gather the time-sequential data in the form of maps and aerial photographs of the project reach.
- Gather and analyze annual peak flows and mean daily flow records within the channel project reach.
- Compare mean daily flows to actual measured flows at the time when the aerial photographs within the project reach were taken.
- Identify annual peak flows that could be expected to cause channel changes in the project reach.
- Do a field inspection, making personal observations of the project reach.
- Analyze the channel migration.
- Analyze the width of the channel from the digitized photographs and the "GIS" software at 500-foot intervals to determine width.
- Apply hydraulic geometry to compare the average widths and conveyance capacities.

Harvey testified that the methodology that he employed has been reviewed in the scientific literature and is generally accepted in the field of fluvial geomorphology in determining the location of the main channel and the thread of a stream, including reliance by similarly situated experts upon

materials, data, and equations about rivers similar to those that he used.

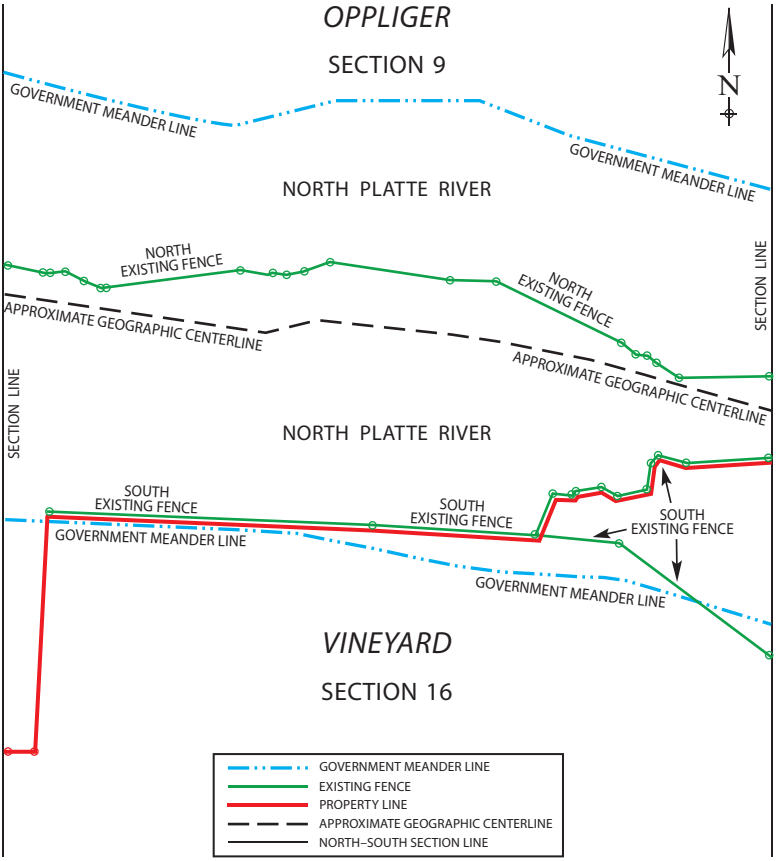
(d) North Fence—Edwards, Lincoln County Land Surveyor

For more than 6 years, Edwards has been the Lincoln County land surveyor, a part-time position. Additionally, she operates a surveying company along with her husband and son. Edwards has over 30 years of surveying experience. To help the reader make sense of some of what we have already written about, plus grasp the general "lay of the land" (and river), we have reproduced a simplified plat map below. This plat map shows the location of the north and south existing fences in green and the 1870 GLO survey meander lines in blue. (The southern boundary of the Vineyards' land in section 16, shown in red, essentially follows the southernmost "existing fence.") Edwards surveyed and plotted the location of the north fence at the Vineyards' request, and such is shown in green on the plat map below. Edwards testified that the Vineyards had requested that she survey "a fence running east and west along the south side of the north channel of the North Platte River."

This north "existing fence" is located north of the geographic centerline of the North Platte River using the 1870 GLO survey meander lines, but the fence is clearly located on accretion ground as evidenced by Edwards' photographs of the points she used for the metes and bounds description of her survey. She photographed each point she used in mapping the north fence—and all such points are on land. We cannot help but observe at this juncture that the trial court's decision that the thread of the North Platte River is the geographical centerline of the river using the 1870 meander lines means that the trial court has located the thread where there no longer is a river. This fact is also shown on the Edwards survey locating the north fence as reflected by the green dots on the 2006 aerial photograph, reproduced earlier in this opinion, which run alongside the south side of the north channel of the river.

On July 6, 2008, Edwards performed another survey for the Vineyards in section 16, and a copy of that survey was

received in evidence. It plotted the south "existing fence," also shown in green on the plat map below, located to the south of the north fence. For most of its course, that "south fence" follows the south meander line of the North Platte River from the 1870 GLO survey. Edwards testified that this survey was done because the Vineyards were trying to sell their property located to the south of the south fence. The sale occurred, but we skip the details of such except to describe the land the Vineyards retained in section 16 after the sale. After the sale, the Vineyards owned a rectangular strip of land on the western edge of section 16 (approximately 210 feet wide by 1,860 feet



long), apparently for access to whatever accretion land the Vineyards owned in section 16. This strip of land is outlined in red on the plat map above, as is the balance of their southern boundary that mostly follows the south fence. After the sale, other than the described and outlined strip of land, they owned only accretion land in section 16 lying north of the south fence—as ultimately established via this litigation.

At this point—in view of the Vineyards' alternative claim that they own land up to the north fence as an agreed boundary, if not to the thread of the stream located in the north channel, we digress to tie these surveys into some other evidence. At the time of these surveys, section 9 was owned by the Bar B Cattle Company. The evidence is that a real estate agent or broker was working to sell the Vineyards' land south of the south fence and that he contacted the Bar B Cattle Company's president and presented her with a copy of the survey of the north fence. He then asked her to sign a boundary agreement stating that the north fence, as platted on the first survey by Edwards as shown on the plat map above, was the boundary between the Bar B Cattle Company's land in section 9 north of the river and the Vineyards' section 16 land south of the river. She informed him that she did not agree that the fence was the boundary. According to her testimony, she never signed the boundary agreement and the north fence was not a boundary fence; it was only to keep cattle out of the river. The trial court expressly adopted this testimony in its factual findings.

Additionally, Edwards conducted another survey at the request of the Vineyards for the purpose of "locat[ing] the existing north channel of the North Platte River." Her methodology was to locate the north and south sides of the north channel and survey the channel using the water's edge. Using that data, Edwards computed a geographic centerline of the north channel of the North Platte River, which centerline was then laid over a copy of the 2006 aerial photograph to produce a composite survey map. She also platted the other surveys that she had done in the accretion land between sections 16 and 9 onto the same composite map. This centerline of the north channel as she plotted it is shown on that map. In her

testimony, Edwards indicated that the term "geographic center line" is a term of art in the surveying business to indicate the center between the two meander lines on a GLO survey. In describing her methodology, Edwards said: "We shot the north bank and the south bank and then I just took the mean divide, you know, from point to point, divided it in half."

3. Did Trial Court Err by Relying on Evidence Outside Trial Record?

The Vineyards argue that the trial court erred by considering evidence outside the record. This argument derives from the trial court's discussion, in its written decision, of the case of *Anderson v. Cumpston*, 258 Neb. 891, 606 N.W.2d 817 (2000), a boundary dispute case in Dawson County involving the Platte River and its multiple channels. *Anderson* was decided at the trial level by the same trial judge as in the present case. In the section of our opinion entitled "District Court Decision," we have set forth what the trial judge's written decision had to say about *Anderson*. The appellants' brief does not identify any place in the voluminous trial record where the trial judge improperly mentioned the *Anderson* decision or, for example, took judicial notice of some piece of evidence from that trial—and our review of the record does not turn up any such instance of improper reliance upon, or use of, *Anderson*.

Rather, it is apparent that the trial judge was using A*nderson* as precedent, and whether we agree with his application thereof is a different question from that which the assignment of error presents and is one which we will ultimately address. We find no use of evidence outside the record, and thus, the assignment of error is without merit.

4. Is Boundary Established by North Fence?

[11,12] Relying on the testimony of Bar B Cattle Company's president, the trial court found that the north fence as surveyed and platted by Edwards was not a boundary fence. Nebraska law provides that boundaries that have been mutually recognized and acquiesced in for a period of 10 years can be legal boundaries. See § 34-301. In order to claim a boundary line by acquiescence, both parties must have knowledge of the existence of a line as the boundary, and therefore, the

mere establishing of a line by one party and the taking by that party of possession up to that line are insufficient. *Kraft v. Mettenbrink*, 5 Neb. App. 344, 559 N.W.2d 503 (1997). Here, there is evidence from the prior owner (until 2007) of the Oppligers' land that she did not recognize the north fence as a boundary, it was never intended as such, and it was to keep the cattle out of the river. Further, she refused to sign an agreement identifying the north fence as the boundary when asked to do so by the Vineyards' real estate agent when he was attempting to establish boundaries in connection with the sale of the Vineyards' land. The trial court "accept[ed her] testimony," and under our standard of review, we give weight to the fact that the trial court heard the witnesses testify and observed their demeanor. After our review of the record, we are likewise persuaded that the north fence is not a boundary line by acquiescence, and we too find the testimony of Bar B Cattle Company's president determinative on this issue. Thus, the north fence is not the boundary between the lands of the Vineyards and the Oppligers.

5. Is Boundary Established by Adverse Possession of Accretion Lands?

The discussion that follows in the next section of our opinion effectively moots the Vineyards' claim that they have acquired the accretion land from the southern boundary to the north fence surveyed by Edwards. See *Kelly v. Kelly*, 246 Neb. 55, 516 N.W.2d 612 (1994) (holding that appellate court is not obligated to engage in analysis which is not needed to adjudicate case and controversy before it).

6. Can Thread of Stream of North Platte River Be Reliably Determined, and If So, Where Is It?

The question posed in the subheading above is the essence of this case. The north-bank landowners, the Oppligers, produced an expert who placed the thread of the stream in the south channel, giving them the lion's share of the accretion land. The south-bank landowners had an expert witness who placed the thread in the north channel, which gives them the majority of the accretion land. And, there was a survey plat

offered and received which purports to plot the "geographical centerline" of the north channel. Upon a finding of "impossibility" of locating the thread of the stream of the North Platte River, the trial court rejected the ultimate opinions of both experts and located the boundary between the north-bank and south-bank landowners' properties at the geographic centerline of the North Platte River meander lines as surveyed in 1870 by the GLO.

While *Anderson v. Cumpston*, 258 Neb. 891, 606 N.W.2d 817 (2000), at first blush may appear to be authority for the district court's decision, that case and this case are materially different in a number of important ways. First, it was the Platte River that was involved in *Anderson*, not the North Platte River. But, most significantly, there was a judicial admission in *Anderson* by the south-bank landowner that "'the Platte River flowed seasonally bank to bank and the geographical center line roughly corresponded to the thread of the stream.'" 258 Neb. at 893, 606 N.W.2d at 820. Additionally, the south-bank landowner admitted that "'artificial structures and diversions led to sudden reductions and shifts in the flow of the stream resulting in the Platte River becoming a braided stream with many small channels.'" *Id.* at 893-94, 606 N.W.2d at 820. The trial court then found that for all practical purposes, it was impossible to ascertain the present location of the thread of the Platte River, but the court did not need to actually determine such location, because the doctrine of avulsion means that the boundary of the south-bank landowner's property should remain "as it was[,] in the center of the old channel." *Id.* at 899, 606 N.W.2d at 823, citing *Ziemba v. Zeller*, 165 Neb. 419, 86 N.W.2d 190 (1957). Additionally, the Supreme Court cited the testimony of the adjoining landowners, who testified that the boundary between the north and south banks was long believed to be the geographic centerline. Finally, there was evidence that landowners in the area had long paid taxes on land to that centerline, and, while the south-bank landowner said he did not know he was being so taxed,

> [e]quity would not be done by taking land away from those who have paid taxes thereon, and regarded and treated it as their own for so long, and granting the land

> to another who has absolutely no reason, on the record before us, to believe that the land was his property.

Anderson, 258 Neb. at 900, 606 N.W.2d at 824.

In the case before us, we have no judicial admissions of the sort present in *Anderson*, nor are there equities associated with payment of taxes, and the competing landowners here are not owners of long standing. While the *Anderson* opinion contains considerable information about the nature and dynamics of the Platte River when originally surveyed, as well as in more modern times after dams, diversions, and bridges had been built, we are dealing with a different river in a different location. Thus, while rules of law from *Anderson* are obviously precedential, the ultimate conclusion of that case cannot simply be grafted onto this case, given the distinguishing factors we have cited. As we emphasized above, *Anderson* involves a different river and a different evidentiary record. Moreover, our record contains substantial evidence from two experts that the trial court deemed qualified to testify as to where the thread of the North Platte River was located in the instant case.

We have de novo review, and our review of this voluminous record has been exhaustive. The Vineyards' expert, Harvey, is a Ph.D. fluvial geomorphologist with what can only be described as substantial educational, teaching, publishing, and testimonial experience. Harvey has authored a comprehensive and compelling report supported by graphs, charts, maps, and various data concerning the evolution of the North Platte River over time as well as supporting his ultimate opinion as to the location of the thread of the stream. And he articulated and followed a concise scientific analytic path to reach his conclusion. In short, Harvey's experience and credentials, as well as his fieldwork and calculations in the course of this case, make him a credible witness when he testifies that in his opinion, the thread of the North Platte River is located in the north channel. Thus, we reject the trial court's finding that in the project reach involved in this case, it is "impossible" to locate the thread of the stream.

Moreover, it is impossible to ignore the superior educational, academic, and experiential qualifications of Harvey when compared to those of Mainelli. To the extent that the trial

court relied on its questioning of Mainelli in placing the thread at the geographic center of the meander lines from the 1870 GLO survey, we find that conclusion fundamentally flawed. In answering the court's question about the thread of the North Platte River in 1870, Mainelli assumed that the geographic centerline of the 1870 meander lines would equal the thread of the river without any knowledge, or testimony, of what the river actually looked like or what type of river it was in 1870. And the only evidence in the record on that score does not establish that when the surveyors in 1870 drew the meander lines, the river flowed "bank to bank" between those lines—which is the implicit prerequisite in Mainelli's answer to the court's question whether the geographic center in 1870 was the thread of the river. However, there is an assignment of error dealing with the question of the location of the thread of the stream in 1870 that we must deal with.

During the trial, the judge asked whether Mainelli had an opinion to a reasonable degree of certainty in his field of expertise as to whether in 1870, at the time of the original GLO survey, the geographic centerline between the original meander lines was at or near the center of the stream, to which question counsel for the Vineyards objected "as to foundation; lack of personal knowledge, [§] 27-702." The objection was overruled, and Mainelli responded, "Without any additional information and [with] the lack of detail, that would be a reasonable assumption." We note that the 1870 GLO survey does not portray the North Platte River as a braided stream; nor does it reflect any channels or islands whatsoever in the project reach. On the 1870 survey, the river appears simply as a wide single-channel river running between the north and south meander lines.

However, the Vineyards' counsel attempted to have Harvey address the same issue—the location of the thread of the stream at the time of the 1870 GLO survey. Objections were made by the Oppligers' counsel which the court sustained, saying, "I think we are making a lot of assumptions based on a[n] 1870 survey that doesn't show where the channel was." An offer of proof was made in which Harvey explained that when water travels through a curved channel, the water on the

outside of the curve travels at a higher velocity than the water on the inside of the curve, resulting in more scour of the riverbed and making it deeper on the outside of the curve—which asymmetry he described as a "fundamental characteristic of flows in fluvial channels." Thus, it was Harvey's opinion with a reasonable degree of certainty that "because of the macroscale meander patterns shown between the meander lines"—meaning, we assume, the curve to the north and then back south—"and the presence of river-eroded bluffs on the north side, . . . the main conveyance channels would more likely than not have been in the northern portions of Sections 16 and 17 at the time of the [1870] government survey."

Initially, it was obviously inconsistent for the court to let Mainelli opine on this issue and then to exclude Harvey's opinion. The Vineyards assign error to the trial court's sustaining of the objection to Harvey's testimony. We agree that the objection was not properly sustained. If Mainelli was qualified to opine on where the thread of the North Platte River was in 1870, then Harvey would obviously also be qualified, given his superior education, experience, and academic qualifications. Moreover, he provided a scientific explanation as to why the deepest part of the river would be located on the north side, whereas Mainelli merely said that putting it in the middle was a "reasonable assumption" but provided nothing as to why it was reasonable. In contrast, Harvey explained why Mainelli's opinion ran counter to fluvial science. Accordingly, we sustain this assignment of error, and in our de novo review, we consider Harvey's testimony that the thread of the stream of the North Platte River in 1870 was located near the north meander line because that is where the outside of the curve in the river is clearly shown on the 1870 GLO survey. And we also note that Harvey provides credible evidence that since 1870, the river has changed by avulsive events—high flows or floodflows—meaning that the thread of the stream now is generally where it was in 1870: near the north meander line. We now turn to Harvey's research and ultimate opinion on where the thread was located at the time of this litigation.

Harvey's analytic work in reaching his conclusions was detailed, comprehensive, and supported by the science of his

field: fluvial geomorphology. Harvey's qualifications and experience are more precisely targeted at the issue being litigated when compared to Mainelli's bachelor's degree in the more general field of civil engineering. Accordingly, we reject Mainelli's conclusion that the thread of the North Platte River is in the south channel.

We now detail the aspects of Harvey's report in evidence and his testimony, which tracks that extensive report, that compel us in our de novo review to accept his conclusion that the thread of the North Platte River is in the north channel. We begin with what the North Platte River was like when first surveyed in 1870. Harvey opines that the river's morphology and dynamics have changed significantly from the 1860's to the present. The flows have substantially decreased, as one might expect, because of upstream dam construction and peak flow storage. Harvey cites an 88-percent reduction in average peak flow of 20,355 cfs between 1909 and 1927 to a 2,407 cfs average between 1957 and 1970, as well as a 66-percent reduction in mean annual flows over the same timeframe—all flow measurement data coming from the Sutherland flow gauge. The flow reduction produced an order-of-magnitude reduction in the width of the channel from 2,591 feet in 1865 to 295 feet in 1965. In short, the river is a much smaller and different river than when surveyed in 1870. And, Mainelli's opinion that the thread was located in the geographic center of the 1870 meander lines does not account for the significant changes in the nature of the river.

Harvey testified that this narrowing of the channel produced vegetation growth, noting that flows below 4,000 cfs are not capable of scouring the vegetation from the sandbars. Thus, the result was that the sandbars were reinforced by the roots of the vegetation. As stated by Harvey, "the increased erosion resistance of the banks and the reduced flood peaks significantly reduce the potential for channel changes except during infrequent larger floods." Prior to the construction of the upstream dams, the river was characterized by constantly shifting sandbars and numerous braid channels around the bars, but after dams were built, the river became "island braided" with more stable vegetated bars and less channel shifting, and by the

1960's, the planform of the river had changed to "anastomosing with stable vegetated bars and a limited number of relatively stable channels." Harvey noted that in such a river as the North Platte River has become, channel changes generally occur as a result of avulsion during infrequent large floods.

Harvey explained that the geomorphic characteristics of the north channel suggest that it is the older of the two channels in the project reach. He cites the fact that in the south channel, there are fewer sandbars and less evidence of bank erosion, which are indicative of reoccupation of former channels where the banks are heavily vegetated and, therefore, erosion resistant. On the other hand, the north channel contains deposits of coarser gravel at the points of the bars, indicative of more reworking over time than in the south channel. In other words, the north channel has, over time, carried more water than the south—remembering that in the 1970 aerial photograph, there was no south channel to be seen, and that such reappeared after the floodflows in 1971 and 1973. Harvey found that there is conveyance of flow from the south channel to the north channel, which flow, coupled with the addition of groundwater from the north and water from East Clear Creek into the north channel, clearly supports Harvey's opinion that the north channel would be the last of the two channels to dry up—meaning that the north channel is the main channel.

With respect to Mainelli's work on this case, which produced his opinion that the thread of the stream is in the south channel, Harvey noted that Mainelli did not gauge the flow in each channel, and therefore, Mainelli was not able to know which was carrying the greater flow. Harvey observed that of the three cross sections taken by Mainelli, the data revealed that in two of the locations, the north channel was lower—noting that water always flows to the lowest point, thereby supporting Harvey's testimony that water would flow from the south channel to the north channel and again supporting the proposition that the north channel would be the last to dry up.

Harvey testified about the aerial photographs of the project reach, and he said that the first photograph, taken in 1938, shows the majority of the wetted channels to be in the north portion of the river and north of the north fence surveyed by

Edwards. Moreover, he noted that while there were channels to the south in 1938, they were carrying considerably less water than the north channel, as evidenced by the 1938 photograph. In the 1958 photograph, all of the wetted channels were to the north of the north fence, and in this photograph, the wetted channels south of the north fence that had been wet in 1938 were no longer carrying flow and had been closed off—they had dried up, yet the north channel was still carrying flow. In the 1965 aerial photograph, the river appears as island braided, all of the wetted channels were north of the north fence surveyed by Edwards, and no active channels were located south of the north fence. The 1970 aerial photograph shows that all wetted channels in section 16 were to the north of the north fence except for a single braided channel located south of the fence line in the eastern portion of section 16. Harvey testified the 1974 aerial photograph shows that avulsion had occurred between the time of the 1970 and 1974 photographs and that relic channels south of the north fence had been reoccupied by flow—although the bulk of the wetted channels was located north of the north fence. And, we recall that at the time of his field inspection, those relic channels were no longer flowing but merely had standing or static water.

Harvey noted that the flow data shows peaks of 9,090 and 7,620 cfs, in 1971 and 1973 respectively, of relatively long duration and that "it is reasonably probable that [the peak flows] were the cause of the avulsion to [create] what is now[,] in general terms, the South channel." As indicated in our initial summary of applicable water law, changes in the location of the river or its channels caused by avulsion do not change the boundary, whereas changes by accretion would change the boundary.

According to Harvey, the 1978 aerial photograph shows that the majority of the flow of the river in sections 16 and 17 was located north of the north fence. Harvey's examination of the 1985 aerial photograph led him to conclude that the high flows in 1983 (6,540 cfs) and 1984 (6,390 cfs) were likely the cause of the reopening of the south channel shown in that photograph, but that nonetheless, the majority of the flow was north of the north fence. When the 1999 aerial photograph was taken, the flow data at the time indicates a fairly even split between

wetted channel areas—55 percent north and 45 percent south. By the time of the 2006 aerial photograph, the split between the wetted channel areas was 58 percent north and 42 percent south. Below, we have reproduced Harvey's chart showing the division of the wetted channel area at the time of the aerial photographs discussed above.

Table 2.3. Wetted channel areas within Sections 16 and 17 from 1938 to 2006.

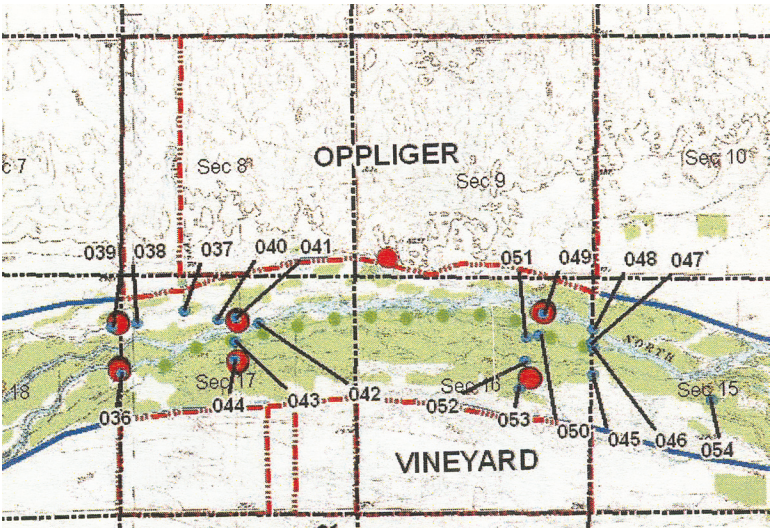
Year	Total Wetted Area (acres)	North Channel Area (acres)	Percent Total	South Channel Area (acres)	Percent Total
1938	328.5	220.6	67%	107.9	33%
1958	87.2	84.0	96%	3.2	4%
1965	67.6	63.3	94%	4.3	6%
1970	106.9	98.4	92%	8.5	8%
1974	195.7	126.2	64%	69.5	36%
1978	130.4	98.3	75%	32.1	25%
1985	211.8	134.8	64%	77.0	36%
1999	149.1	82.3	55%	66.9	45%
2006	153.1	88.7	58%	64.4	42%

Additionally, we have reproduced below Harvey's chart showing flow of the North Platte River at the time of the various aerial photographs discussed above as measured in mean daily flow, the data again supporting the fundamental fact that the river is smaller and different than it was in 1938—and certainly than it was when surveyed in 1870, when only meander lines were plotted.

Table 2.1. Summary of aerial photography and flow data, North Platte River, Lincoln County, Nebraska.

Year of Photography	Date of Photography	Mean Daily Flow (cfs) at North Platte River near Sutherland Ga[u]ge (No. 6691000)
1938	7-21-1938	938
1958	7-6-1958	108
1965	10-2-1965	163
1970	11-15-1970	242
1974	10-15-1974	146
1978	10-8-1978	589
1985	7-5-1985	1480
1999	5-7-1999	82
2006	5-15-2006	25

Harvey used hydraulic geometry, citing a recognized authority: Luna B. Leopold & Thomas Maddock, Jr., Dept. of Interior, The Hydraulic Geometry of Stream Channels and Some Physiographic Implications, U.S. Geological Survey Professional Paper 252 (1953). Hydraulic geometry is used in fluvial geomorphology to describe the relationships between discharge, flow width, depth, and velocity in a channel. Harvey used a formula defined by the authors of the above-stated authority, using the static values as the authors determined such for Midwestern rivers as the North Platte River. In order to use the formula, channel widths have to be determined, which Harvey did based on the 2006 aerial photograph. His channel width values were based on 21 measurements of the channels' width taken at 500-foot intervals along the river from the west line of section 17 to the east line of section 16, a distance of 2 miles. The reproduction which appears below, from an exhibit excerpted from Harvey's report, shows the river in sections 8 and 9 on the north and 17 through 15 on the south—looking left to right. The larger red dots are the places where Mainelli took his three cross sections, and the small blue dots are the locations visited by Harvey on September 9, 2009, as he recorded



them by GPS, which dots are numbered 036 through 054. The green dots depict the north fence as surveyed by Edwards, as previously discussed.

Harvey stated that he determined that the flow capacity of the north channel in 2006 was about 40 percent greater than that of the south channel, using average widths of 133.6 feet for the north channel and 81.2 feet for the south channel. Harvey then opined that "therefore, the North channel was the dominant channel in 2006."

We note that in the trial of this case, the terms "dominant channel" and "main channel" were used interchangeably. The rule is well established that where the thread of a stream is the boundary between estates and that stream has two channels, the thread of the main channel is the boundary between the estates. *Monument Farms, Inc. v. Daggett*, 2 Neb. App. 988, 520 N.W.2d 556 (1994), citing *Hardt v. Orr*, 142 Neb. 460, 6 N.W.2d 589 (1942). Clearly, Harvey's opinion about which channel is the main or dominant channel is crucially important, and we find that conclusion well supported by the data and the science which we have set forth above in considerable detail.

Because we accept Harvey's opinion that the north channel is the main or dominant channel, we necessarily must reject the trial court's conclusion that "[i]t is impossible at this point in time to determine the thread of the North Platte River" other than to use the geographic centerline as measured by the GLO in 1870. As we understand the trial judge's rationale, it is because there is no credible evidence to "prove which channel will completely dry up" first. That conclusion clearly ignores the evidence from Harvey that the north channel is wider and is lower in elevation and that there is flow from the south channel to the north channel, as well as water coming into the north channel from East Clear Creek as well as from groundwater which flows to the south, plus the simple fact that the north channel carries more flow—all reasons Harvey cited for his conclusion that the north channel would be the last to dry up.

With all due respect to Mainelli, we find that Harvey's work in locating the thread of the North Platte River at the thread of

the north channel has a level of complexity, completeness, and sophistication that significantly exceeds that of the work done by Mainelli. Harvey's ultimate conclusion is supported by a multilayered analysis using various aspects of hydrology and hydraulics that makes his conclusion compelling and undermines the trial court's finding that the thread of the stream is impossible to locate. And, as outlined earlier, this case is different in many material respects from *Anderson v. Cumpston*, 258 Neb. 891, 606 N.W.2d 817 (2000), the case from which the trial court's finding seems to have been derived. Having rejected the trial judge's conclusion that locating the thread of the stream of the North Platte River is impossible, acceptance of Harvey's findings and ultimate conclusion as to the thread's location naturally follows. Harvey is obviously well qualified by education and experience to do the work he did and reach the conclusion that we now accept. There is nothing in the record or the trial court's decision that explains why the opinion of Harvey, a Ph.D. fluvial geomorphologist, should be rejected, and we have explained a number of reasons why Harvey was more persuasive and credible than Mainelli. This is not merely a difference of opinion between equally qualified and experienced experts. Harvey's opinion has a much more solid foundation in science; plus, he possesses education, training, and experience superior to Mainelli's.

Therefore, we hold that the boundary in the accretion lands of the North Platte River between the Oppligers' land in section 9 and the Vineyards' land in section 16 is the thread of the stream of the north channel of the North Platte River. As to precisely and exactly where that is in a metes and bounds description, such is not before us and is inherently impractical, and in reality, such would rarely be subject to precise measurement and legal description beyond the conceptual definition we have employed for the thread of the stream throughout our opinion. Therefore, the thread of the stream of the North Platte River is found in the north channel, and it fits the definition of "thread of the stream" from *Monument Farms, Inc. v. Daggett*, 2 Neb. App. 988, 995, 520 N.W.2d 556, 562 (1994):

> The thread or center of a channel, as the term is employed, must be the line which would give the owners on either

> side access to the water, whatever its stage might be, and particularly at its lowest flow. *State v. Ecklund*, 147 Neb. 508, 23 N.W.2d 782 (1946). In other words, the thread of the stream is the deepest groove or trench in the bed of a river channel, the last part of the bed to run dry.

[13] Although there is in evidence a composite survey map by Edwards that plats the geographic centerline of the north channel superimposed on the 2006 aerial photograph with a metes and bounds description, it is clear that she simply platted the middle of the north channel measured bank to bank. While that could be the thread, as a matter of law, it is not such by virtue of simply being the centerline. In *Hartwig v. Berggren*, 179 Neb. 718, 725-26, 140 N.W.2d 22, 27 (1966), the court observed:

> Plaintiff contends that the mean line of the center of the river is a factor in determining ownership by a riparian owner of unplatted islands in a river. We think not. The meander lines of the river as fixed by the original government survey are not boundary lines unless designated as such in the instrument of conveyance. The mean center line of a river, determined by dividing the distance between meander lines of the river, is an arbitrary location of the center of the stream and is not a determination of the thread of the stream in this jurisdiction.

We observe that as a practical matter, the precise and exact location of the thread would become important only in times of drought and extremely low flow. Of the numerous Nebraska cases involving the thread of a stream, none contains a precise metes and bounds legal description of its location. See, e.g., *Anderson v. Cumpston*, 258 Neb. 891, 606 N.W.2d 817 (2000); *Babel v. Schmidt*, 17 Neb. App. 400, 765 N.W.2d 227 (2009); *Madson v. TBT Ltd. Liability Co.*, 12 Neb. App. 773, 686 N.W.2d 85 (2004). We conclude that such a description is neither required nor practical given that the thread of the stream is a legal concept and that pinpointing its exact location is inherently difficult, if not impossible, until a river actually dries up, which event would then reveal the thread's precise location, i.e., where the last little bit of flowing water could be found.

VII. CONCLUSION

The Vineyards have asserted other assignments of error, mostly involving evidentiary issues that we have not discussed because we need not do so. An appellate court is not obligated to engage in an analysis which is not needed to adjudicate the case and controversy before it. *Spanish Oaks v. Hy-Vee, Inc.*, 265 Neb. 133, 655 N.W.2d 390 (2003). Accordingly, we reverse the decision of the district court for Lincoln County. We hold that the boundary between sections 9 and 16, "Township 14 North, Range 34 West of the 6th P.M.," is the thread of the stream of the North Platte River, which thread is located in the river's north channel as it runs between those two sections.

REVERSED.

CASSEL, Judge, participating on briefs.

MATTHEW JOHN BOCK, APPELLEE, V.
JENNIFER LYNN DALBEY, APPELLANT.
809 N.W.2d 785

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1. **Divorce: Property Division: Appeal and Error.** In an action for the dissolution of marriage, an appellate court reviews de novo on the record the trial court's determination of property division; this determination, however, is initially entrusted to the trial court's discretion and will normally be affirmed absent an abuse of that discretion.
2. **Judgments: Words and Phrases.** An abuse of discretion occurs when a trial court bases its decision upon reasons that are untenable or unreasonable or if its action is clearly against justice or conscience, reason, and evidence.
3. **Divorce: Property Division.** If premarital property can be identified, it is typically set off to the spouse who brought the property into the marriage.
4. **Constitutional Law: Statutes.** Under the Supremacy Clause of the U.S. Constitution, state law that conflicts with federal law is invalid.
5. **Divorce: States.** The whole subject of domestic relations is generally considered a state law matter outside federal jurisdiction.
6. **Divorce: Taxation.** It is within the discretion of the trial court in a dissolution of marriage proceeding to order the parties to file a joint income tax return.

Appeal from the District Court for Douglas County: JOHN D. HARTIGAN, JR., Judge. Affirmed.