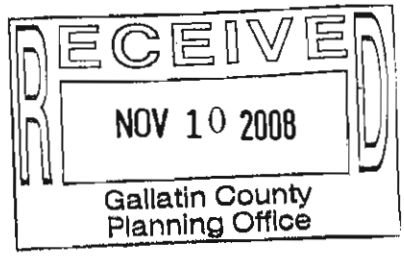
MEMORANDUM



TO: Tom Rogers, Planner
Gallatin County Planning Department

FROM: Paul Shennum & Sandy McManus

DATE: November 7, 2008

SUBJECT: Data for the Conditional Use Permit ("CUP") for the Storey Pit Amendment

Sandy McManus and I are submitting this data for your use and consideration when the CUP is developed and is to be presented to the County Commissioners. I attended the public meeting on the CUP for the Morgan Pit, and I also testified at the meeting. Much excellent work was done going through the process for the first time. There is always a solution that is reasonable and will benefit all concerned.

The process for the Storey Pit CUP may be different because it is an amendment; however, there are concerns that should be considered carefully before presenting the CUP to the Commissioners. The issues of concern to the citizens that live along Highway 84 from the pit entrance to the Four Corners intersection (approximately 1.8 miles) is noise, traffic safety and property values. Attached to this memorandum are attachments that we would like the planning department to review and consider prior to the finalization of the CUP.

Attachment 1 is our comments submitted to the DEQ on the Storey Pit Amendment. The comments state very clearly the increase in noise from the gravel truck traffic along Highway 84. We installed a privacy fence in an attempt to gain back some of a loss in our quality of life. Currently along Highway 84 there is no speed limit difference between trucks and cars, like there is on I-90 (65 mph vs. 75 mph). Highway 191 has this distinction approximately 1.1 miles south of Four Corners (60 mph vs. 70 mph). Also along 191 from Four Corners, there is a speed limit transition from 45 mph to 55 mph to 70 mph. As stated in the attachment, this issue would be mitigated if a separate truck speed limit was installed to the pit entrance. For every 5 mph reduction, the noise level of gravel trucks decreases by one order of magnitude (10 dba). We suggest a limit of 45 mph. Additionally there should be no use of compression brakes as that is when the noise reaches its highest decibel level. This would require a traffic study by the Montana Transportation Department (MTD) and cooperation with the County Road Department. Sandy requested the MTD do a traffic study two years ago. To her knowledge it was done and forwarded to the county but no action seems to have been taken. A new study needs to be done and communicated to the people along the pit route so they can input their concerns.

The next four attachments address the issue of the Impact of Gravel Pits on Residential Property Values. To not address this issue is a deficiency in the CUP process. There is overwhelming scientific data developed by renowned academic institutions that show the effect of loss in property values. These academic institutions have developed models which accurately predict the loss in

property values. It is true that once the pit stops operating and the area is restored, the values will return to their original values. However in the operational time frame (10 years or greater), there is a loss. At the Morgan Pit Hearing, the first speaker, Jane Ward, who lives less than 600 yards from the pit will likely be affected over the operational lifetime of the pit because of her situation and her husband's health. It could be as much as 25-30% (see Figure 1, Attachment 3).

Attachment 2 is a response to an e-mail I sent to Professor Hite at the Auburn University on November 6, 2008. Her response to the e-mail is contained in attachment 2. I quote her first paragraph:

> Based on 2,812 house sales observations within five miles of a gravel pit in Delaware County, Ohio, I conclude that gravel pit operations have a statistically demonstratable negative impact on nearby house prices.

Her modeling accurately predicts and accounts for the necessary variables in order to be scientific correct. I have also attached additional data of hers in Attachment 3 (note the reference list for further information). Figure 2 in attachment 3 shows that after about 10 years the value has returned to its original value, but that a similar home not near the gravel pit increased above the original value of $120,000 by $50,000. Attachment 3 also represents some of her previous work (note the reference list for further information).

Attachment 4 is a Memo sent by Tom Fiddaman to the Montana DEQ, DOR. It is similar to the Exhibit D in your Staff Report to the Commissioners dated November 5, 2008 regarding the Morgan Pit. As he did in Exhibit D, he refutes the Rygg study and the Fairbanks Assessment on the impact of property values. He states on page 8 of his review of the Rygg Report:

> Because the conclusion of the Rygg report, Fairbanks Memo, and EAs contradict common sense and a large body of literature, I wondered whether obvious effects of gravel pits could be detected using a more comprehensive survey of properties.

He did such a survey in the Rainbow Subdivision and found the effect of the pit (Nuss) is $23,000 in property values over about a half mile (see page 8). For completeness, I have attached the Rygg Study (attachment 5).

To properly protect the assets of all homeowners in and around a gravel pit, this needs serious consideration. To say, "When a person buys in an unzoned area, there is a risk," is saying anyone could do what he wants and so be it. This statement was quoted at the Morgan Meeting by Mr. Lee representing TMC. We recommend using the large data base in the scientific community and similar analyses like Tom Fiddaman to establish a methodology to use assessed valuation surrounding a gravel pit. A percentage of this evaluation (10-15%) could be bonded by the pit operator. If a situation like Jane Wards did develop, she would have a way to present a claim against the bond. The claim could be adjudicated by an independent committee made up of. for example. a realtor representative, a pit representative, and a homeowner representative. The actual method to

adjudicate would be determined by the commissioners. In addition the commissioners would set a time period after which the bond would elapse.

There is a solution to all situations.

ATTACHMENT 1

Comments on the Storey Pit Amendment

As residents living at 27793 Norris Road, Hwy 84, we reside 1.1 miles west of the Four Corners intersection and approximately a half mile east of the Storey pit entrance. Your draft EA for TMC's request to expand mining operations on an additional 67.3 acres at the existing site is flawed in numerous areas, especially in Sections 8, 9, 11, and 17. Our comments follow below.

In short, your general overall conclusion is that operations of the pit with this Proposal Change will have no general affect on the health, safety, and quality of life for people living along Hwy 84 and in the near vicinity of the mining operation. There are factors that you, DEQ, continue to ignore as not in your sole responsibility. MEPA and the State Constitution require you to ensure and protect the people's right to an environment that preserves their quality of life.

We participated in the public hearings on the initial application and draft EA in 2004. Our concerns on our quality of life were ignored as not significant. We will now tell you what we have had to do in an attempt to preserve what we had before the pit went to operation. To reduce the increase in noise levels we have had to install a privacy fence of 8 foot height in front our house facing the road and a 6 foot fence around the rest of our property for a cost of $23,500.00.This has helped to a degree.

We have had in the last 2 years nearly 3 side collisions from gravel trucks going west to the pit as they are traveling at 60 mph or greater. This does not include numerous near rear end collisions as we slow down to pull into our driveway. After the trucks are filled and come back from the pit and down the hill west of our house the problem is the same as it was with them going to the pit but now with a full load thcir stopping distance is even greater. The fast moving gravel trucks pose a safety hazard to our lives as we pull of our driveway.

In the summers of 2006 and 2007, I made numerous measurements of noise levels as well as a truck traffic count. This data refutes your information and casts doubt on your conclusions. The measurements varied over the time of the day and summer months but are statistical significant. I used the same noise meter you reference in your original draft EA so they are comparable. I am an engineer and I have a PhD in Aeronautics and Astronautics so I am familiar and technically knowledgeable in noise levels and their measurement. The speed limit in front of our place and leading to the pit entrancc is 60 mph. It is 45 mph from the Four Corners Intersection to just short of Big Boys Toy and then it changes to 60 mph the rest of the way to the Madison River. Most all vehicles are going 60 mph or faster as they reach our place unless they are turning left onto River Road which is right across from our driveway. The results of the statistical significant samples are: Cars-52 to 58 dba, SUVs- 59 to 63 dba, Pickups- 62 to 68 dba, Commercial 18 wheelers-75 to 85 dba, Gravel Trucks- 92 to 102 dba. There was irony in my presence during these

measurement periods; when they returned by our place full from the pit and saw me pointing at them they slowed done so that their measurements fell significantly to the mid 70's. This represents a two order of magnitude drop in noise level and is acceptable to the ear. On occasions the gravel trucks will use their compression brakes to slow done. That is when the noise levels reach their peak.

In the draft EA, DEQ mentioned that on the average, 3500 vehicles drive Hwy 84 each day. The real significant information is truck traffic not total vehicle traffic since, as shown above, it is the real nuisance. In measuring truck traffic during these measurements periods, the ratio of commercial trucks to the other vehicles mentioned above was 1/10 to 1/15 depending on the time of day. This means that a high percentage is normal traffic an not a true nuisance. Therefore on an average day 235 to 350 commercial trucks pass our property each day before the pit started operating. This is the important number DEQ should use in there analyses. Your calculation is for 40 average daily trips. On days when I made my counts the trips on some days ran from 80 to 110. Using these numbers the increase in truck traffic that affects quality of life could vary between 31 to 42%.

You refer to the area around the pit as: "The existing areas around the site are agricultural and pasture land with scattered 20+ acre residential properties." From the Four Corners Area, there are numerous residences and a mobile trailer park leading to the pit entrance. This is true west of the pit but not east of the pit as you go to the Four Corners intersection and past our property.

Some other statements in the draft EA that are suspect are: "Other than a slight increase in truck traffic during operation of the pit, there should be no effect on people using the highway.....", "There is no effect on population and housing from the Proposed Action", and "The Proposed Action would not result in a shift in any unique quality of the area."

Research data developed Auburn , a renowned university, shows that resideutial property values decrease in and around gravel pits for the reasons stated above as well as some other concerns(air quality). Their data shows impact on property values up to 3 miles (10% decrease) and at one half mile (20% decrease). To say no impact on property values is totally false.

Using the correct data, as we have tried to demonstrate, will get the proper restrictions placed in the Proposed Action. Those restrictions would ensure the pit is a good neighbor and not a hazard to people's right for a safe and quality life. A simple example would be to work with the MTD and the County to make the speed limit from Four Corners to the pit entrance 45 mph. This has a negligible effect on the truck by only adding a transient time of approximately 45 seconds.

Paul D. Shennum
Sandra J. McManus
406-586-6405

ATTACHMENT 3

Figure 1: Impact of Gravel Pit on Residential Property Values:

(Percent Reduction by Distance from Mine)

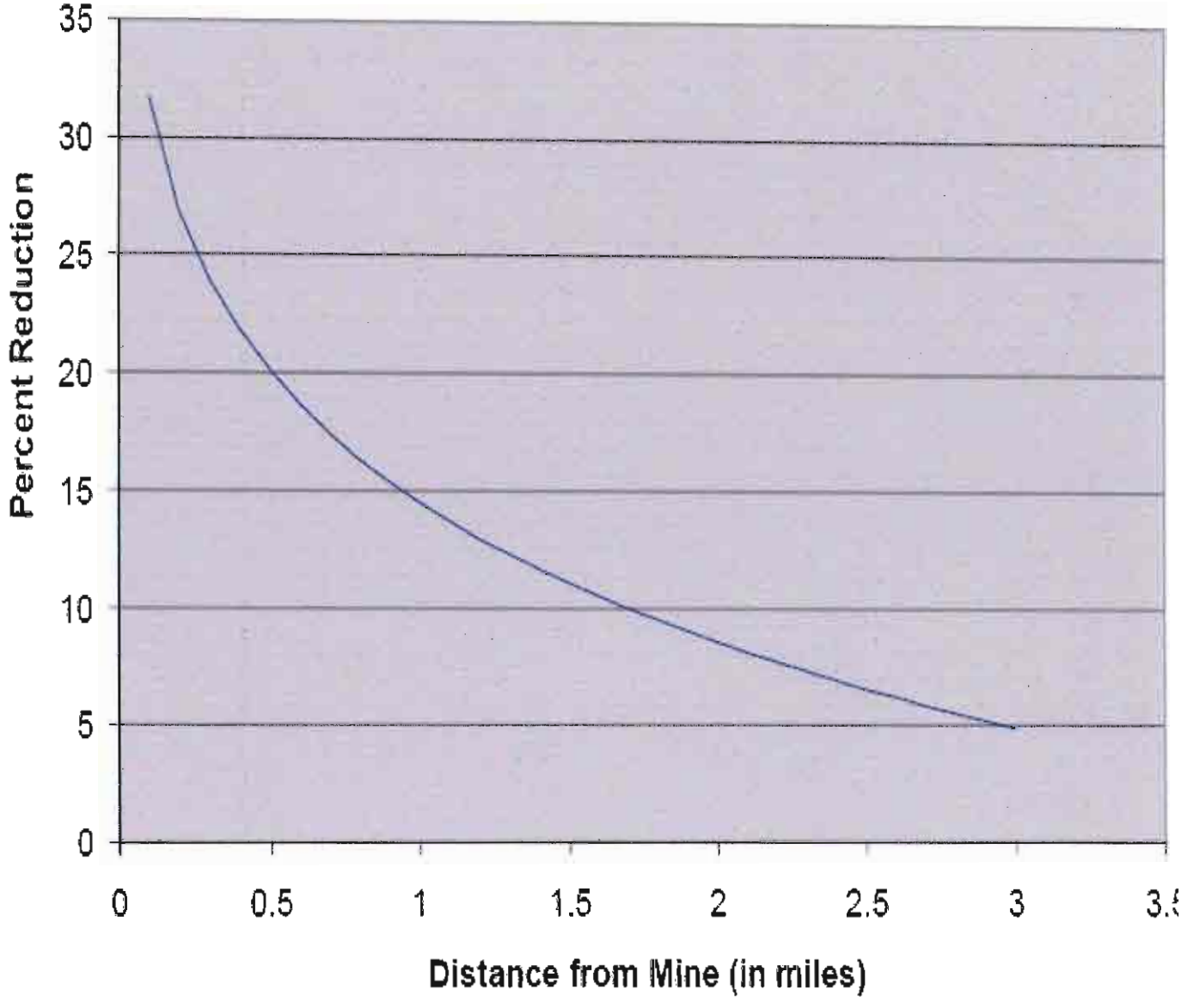
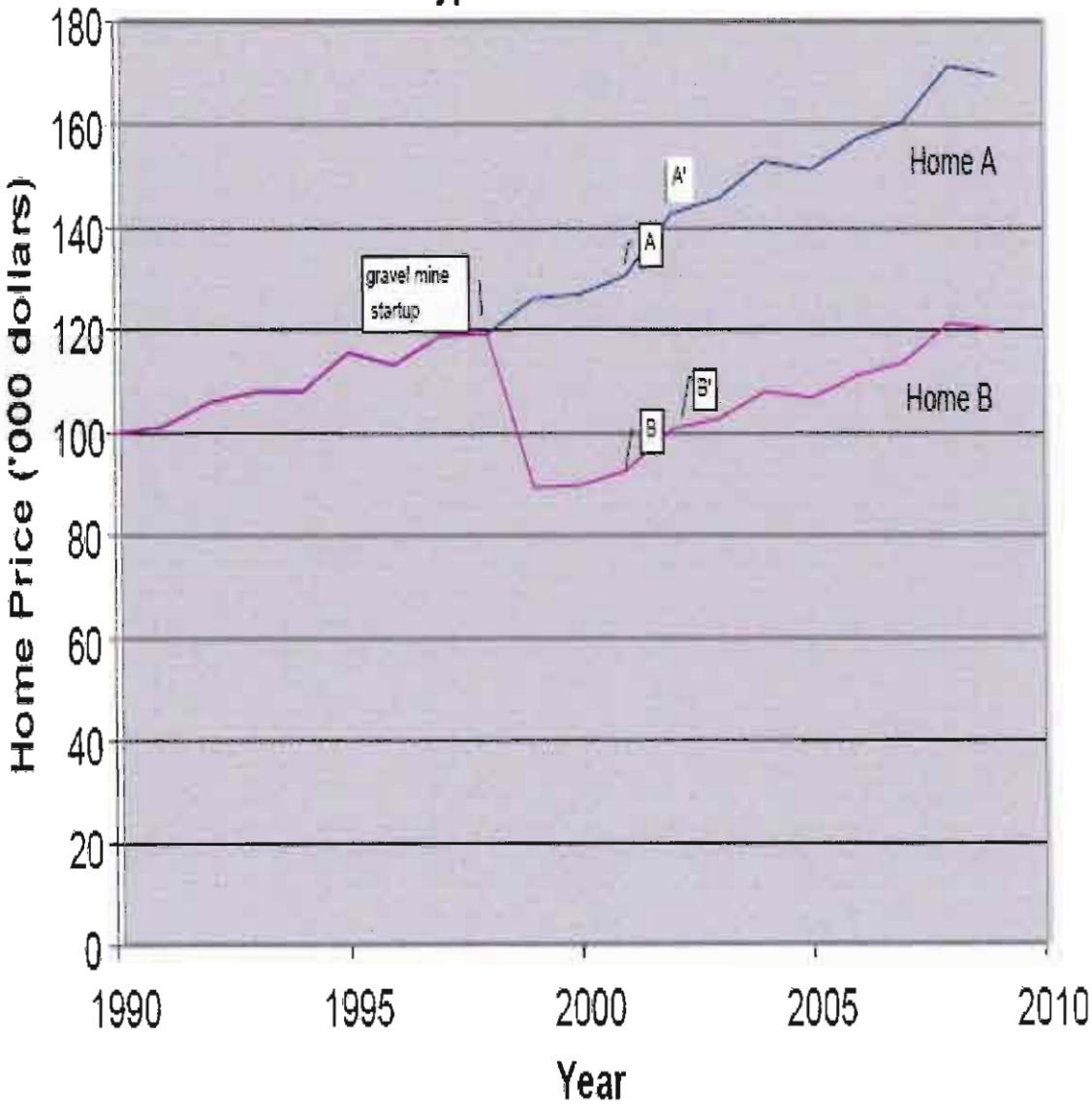


Figure 2: Methodology for Evaluating Gravel Mine Impact on House Prices: Hypothetical Case



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1. Schiller, Bradley. *The Economy Today*, 10th edition, 2006, pages 71-76.

2. Erickcek, George, Senior Analyst. *An Assessment of the Economic Impact of the Proposed Stoneco Gravel Mine Operation on Richland Township*, August 15, 2006. W.E. Upjohn Institute for Employment Research.

3. Higley, Jeffrey. Report by Fox Appraisals to Larry Eckler, a farmer residing near Niles, Michigan, when Moose Lake Mining was granted a permit to mine near Eckler's home.

4. Hitzhusen, Fred and Jeanty, Pierre. *An Economic Impact Study of Lower Great Miami River.* Department of Agricultural Economics, The Ohio State University, 2003, pages 25-30.

5. Hite, Diane, Brent Sohngen, and Josh Templeton. 2003. "Zoning, Development Timing and Suburbanization Patterns of Agricultural Land: A Competing Risks Approach." *Agricultural and Resource Economics Review* 32(1):145-157, April 2003; abstracted on Social Science Research Network.

6. Hite, Diane. 2006. "A Hedonic Model of Environmental Justice." *Social Science Research Network.*

7. Hite, Diane. 2006. "Welfare Impacts of an Environmental Disamenity: A Survival Model Approach." *Social Science Research Network.*

8. Bhattarai, Gandhi R., Diane Hite and David M. Brasington. 2005. "Demand for School Quality, Neighborhood Safety and Environmental Quality: Reflections from Real Estate Market." *Social Science Research Network.*

9. Hite, Diane, Brent Sohngen, and Josh Templeton* 2005. "Property Tax Impacts on the Timing of Land Use Conversion." Department of Agricultural Economics and Rural Sociology, Auburn University, and AED Economics, Ohio State University.

ATTACHMENT 4

To: Montana DEQ, DOR
Re: Nuss Site draft EA, Rygg study, Fairbanks review
From: Tom Fiddaman
Date: 9/22/2008

I was recently made aware of an analysis that the DEQ and DOR have been citing to claim that gravel pits, power lines and other nuisance land uses have no effect on property values. Since this contention defies common sense and the peer-reviewed literature on the topic, I thought it would be useful to review the analysis to determine whether it had merit.

The analysis in question is *Gravel Pits: The Effect on Neighborhood Property Values*, prepared by Philip J. Rygg in 1998 for DEQ. The analysis was reviewed by DOR, as documented in a memo from Jim Fairbanks to Randy Wilke, April 6, 1998. The study and review have been cited in the Lake Helena-Valley Drive Gravel Pit draft environmental assessment, January 2008, and the Keller Site final environmental assessment, July 2007, among other places.[1] Most recently, it appears in draft EA for the Nuss-Rock Gravel Pit application, to which this memo specifically pertains.

My background is in mathematical modeling for public policy and business strategy. I have a PhD in System Dynamics from the MIT Sloan School of Management. In 2006 I won the Forrester Prize, the highest honor in my field, for work on economy-environment interactions. Most relevant to the topic at hand, I am a co-inventor of the patented technology behind the RPX index of residential real estate prices, against which major financial firms write on the order of a billion dollars in contracts.[2] That technology involves mass appraisal of diverse properties, and careful discrimination of market price movements from noise. I am acting purely as a concerned citizen and not on the behalf of any individual, firm, or other organization.

[1] http://deq.mt.gov/ea/opencut/HS&Gextended_LHVDEA.pdf, www.deq.state.mt.us/ea/opencut/KellerFinalEA.doc
[2] http://radarlogic.com

In my review I found the following:

- The Rygg study contains multiple technical problems that preclude its use as a valid measurement of property value effects, including:
    - The method of selection of comparable properties is not documented and is subject to selection bias, exacerbated by the small sample
    - The study neglects adverse economic impacts from land that remains undeveloped
    - The measure of value used by the study, price per square foot, is incomplete and yields results that are contradicted by absolute prices
    - Valuation adjustments are not fully documented and appear to be ad hoc
    - The study does not use accepted statistical methods or make any reference to the uncertainty in conclusions
    - Prices are not adjusted for broad market appreciation or inflation, though it spans considerable time
    - The study does not properly account for the history of operation of the pit
- The Fairbanks review fails to consider the technical content of the Rygg study in any detail, and adds general conclusions that are unsupported by the Rygg study, data, original analysis, or citation.
- Citations of the Rygg study and the Fairbanks review in environmental assessments improperly exaggerate and generalize from its conclusions.

These issues are not minor technicalities. They are major, debilitating problems that that should lead a reasonable person to conclude that no confidence can be placed in the findings. No reputable academic journal would accept the Rygg study or Fairbanks review for publication.

By analogy, suppose that I am attempting to count woodpeckers. I scan the trees. No woodpeckers. Can I assume that there are none? Not necessarily. First, I must ask whether anything else is visible. If I can see only a blur, because my glasses are broken, then I remain in the dark about the woodpeckers. If I can see squirrels and pine needles, then it's fair to assume that, had there been any woodpeckers, I had a chance of seeing

one. But that is still not conclusive. Next, I must consider whether I've properly selected a study area that might contain woodpeckers, whether I've looked long enough and at the right time of day and year to see one, whether I know what a woodpecker looks like, and so forth.

The Rygg study, in effect, concludes "no woodpeckers" without performing these due diligence steps. Without adequate documentation it is hard to be sure after the fact, but it would appear that the study involved peering through the wrong end of the binoculars, in a wheat field, at night, and thus had little hope of detecting the effect it sought to measure. The Fairbanks review and EA citations uncritically repeat the rumor that the woodpeckers have gone missing, without ever wondering what the "tap tap tap" noise in the background might be.

While the legislature may have restricted the ability of DEQ to consider real estate values in its decision making, it did not require use of spurious evidence to falsely alleviate citizen concerns and mollify industrial interests. DEQ's continued citation of studies that contain no reliable information erodes its credibility and my faith in its will to protect the environment and public health.

Given the multiple problems with the Rygg analysis and its subsequent use, DEQ and DOR should cease all reference to the Rygg and Fairbanks documents, remove their citations from the Nuss-Rock environmental assessment, and for future reference commission a proper study of the economics of land use impacts of gravel pits.

Respectfully,

Tom Fiddaman
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Bozeman MT 59715
tom@metasd.com

Review of the Rygg report, Fairbanks assessment, and EA citations

Tom Fiddaman
9/2008

The literature on nuisance land use impacts

There is an extensive academic literature documenting impacts of various land use. It is beyond the scope of this memo to report on all of the findings, so I will merely provide two citations to review articles and a comment:

Melissa A. Boyle and Katherine A. Kiel (2001) "A Survey of House Price Hedonic Studies of the Impact of Environmental Externalities" *Journal of Real Estate Finance* 9(2)[3]

Stephen Farber (1998) "Undesirable facilities and property values: a summary of empirical studies" *Ecological Economics* 24(1)[4]

A common feature of most such studies is proper use of econometric and experimental methods, including use of adequate sample sizes and control of selection bias and other potential problems. While gravel pits have not been widely reviewed in the literature, results for other undesirable land uses (e.g., hazardous waste sites) and environmental

[3] http://cbeweb-1.fullerton.edu/finance/jrel/papers/pdf/past/2001vol9n2/JREL9.2Review02.117_144.pdf
[4] http://dx.doi.org/10.1016/S0921-8009(97)00038-4

attributes (e.g., water quality) do show consistent negative effects, though the magnitude of those effects varies widely.

Orville Bach's 2008 memo, cited in the Nuss and Morgan Family Site draft EAs, identifies additional research specifically relevant to gravel pits.

The Rygg analysis

The Rygg analysis uses the comparable sales method typical of pre-sale appraisals of residential real estate. The goal of a pre-sale appraisal is to establish the plausibility of a price to be paid, in order to protect buyers and lenders. To establish plausibility, an appraisal need only identify a few comparable sales, which after adjustment yield similar value. Unfortunately, this method is not up to the task of measuring effects of environmental changes like a gravel pit, especially over time, for reasons that are described below.

The method of selection of comparable properties is not documented and is subject to selection bias, exacerbated by the small sample

In general, appraisal methods of real estate valuation are subject to bias in the selection of properties. For example, when appraisers know the sale price of a property, they tend to select for comparables that justify a higher price, to ensure a sale.[5] The problem in the Rygg study is not so much that there might be a general upward bias, but that knowledge of prices and conditions in the area of the gravel pit may have consciously or unconsciously influenced the selection of comparables elsewhere.
Unfortunately, the comparable selection process is not documented in any detail, so it is impossible to determine how much effect selection bias might have had. However, there is cause for concern. Rygg notes (pg. 10) "eacb subject sale is compared to a grouping of comp sales that reflect a high degree of similarity to the subject sale, but which are located in neighborhoods without gravel pits" and that comparable sales "are located in unzoned areas of Flathead County that, in terms of economic forces, are reasonably similar to the neighborhood of the subject." This raises two opportunities for bias:

- Areas with similar "economic forces" may be affected by other undesirable land uses or land quality attributes.
- "Similarity to the subject sale" may inadvertently select for low-value properties elsewhere. This is especially problematic if FNMA appraisal guidelines were followed, which state that "The sales price of each comparable sale should be within the general range of the estimate of market value for the subject property."[6]

The problem of selection bias is exacerbated by the small sample size of the study – six subject properties with three to seven comparables each. This is not trivial compared to a typical pre-sale appraisal, but is quite small in a statistical sense. The small sample

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[5] Wolverton & Diaz (1996) "An investigation into price knowledge induced comparable sale selection bias" http://www.rics.org/Practiceareas/Property/Valuation/investigation_into_price_knowledge_19960901.html
Andrew Leventis (2006) "Removing Appraisal Bias from a Rcpeat-Transactions House Price Index: A Basic Approach" OFHEO Working Paper 06-01, February 2006.

[6] See for example http:// www.dallasappraisal.com/images/fnma.pdf

renders it easier to inadvertently select non-representative properties and increases the uncertainty of the results (as described below).

The study neglects adverse economic impacts from land that remains undeveloped or underdeveloped

As a thought experiment, consider a gravel pit surrounded by run-down mobile homes and vacant lots (this should not be difficult to imagine). Using Rygg's criteria, one might select comps from mobile home parks in other disadvantaged areas, neglecting 5-bedroom homes in nearby high-value neighborhoods. The comparison would likely yield similar per-square-foot values for the mobile homes, while ignoring huge differences in total values of land and improvements, even though a portion of that difference would likely be attributable to the fact that few sensible builders would locate expensive homes adjacent to an opencut mine. Similarly, the lost value of undeveloped lots, caused by the location of the pit, would also be entirely neglected.

It is not hard to see that a milder version of the situation above could apply to the study area. Of the six subject properties considered, two are mobile homes and none is as large as the average American home (unless basement areas are considered).

The measure of value used by the study, price per square foot, is incomplete and yields results that are contradicted by absolute prices

The goal of the study, as Rygg notes, is to measure economic obsolescence, the loss of market value from adverse environmental factors. Rygg cites *The Appraisal of Real Estate*, "Since economic obsolescence is not inherent in the improvements, its adverse effect on value may affect the land value, the improvement value, or both."[7] Price per square foot fails to take full account of possible effects, particularly on the land value component.

Valuation adjustments are not fully documented and appear to be ad hoc

Ordinarily, adjustments to comparable property values are reported on appraisal forms.[8] Unfortunately, Rygg does not report adjustments to comparables in his table of property attributes, and does not state detailed values or rationale for most comparisons in the text. Thus it is impossible to determine, after the fact, whether any of the choices are justifiable.

The study does not use accepted statistical methods or make any reference to the uncertainty in conclusions

Because Rygg does not report a comprehensive set of adjusted property values, it is not possible to draw any formal inference about the relationship between the subject properties adjacent to the pit and the adjusted comps. Statistical tests using the reported values fail to reliably distinguish between subject and comparable properties. For example, simple two-sample tests for difference of means with unequal variance yield null results for both price and price per square foot.

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[7] American Institute of Real Estate Appraisers, Chicago IL, pg 258
[8] Ibid.

In an attempt to fully exploit the Rygg data that is available, I experimented with several linear and nonlinear regressions of price and price per square foot against property attributes. None yielded a statistically significant, or even sensible, result for the effect of location on value. For example, the simplest model (a linear regression against price) yields a gravel pit effect of -$7300 to +$25,500 (i.e., the measurement indicates that the mine is a benefit, but not reliably different from zero).

The conclusion one should draw from this is not that mines may be a benefit. When confronted with results that contradict common sense and economic theory, one should first ask whether the study is correctly measuring the effect in question. Are there opportunities for bias? (Yes.) Is the sample large enough? (No.) Do alternate measures, like price and price per square foot, yield consistent results? (No.) In this case, we must conclude that we remain uninformed about the effect.

Prices are not adjusted for broad market appreciation or inflation, though the study spans considerable time

Transactions cited span the period from 1993 to 1997. It is not clear what rate of appreciation prevailed in the area over that interval, but it is quite possible that timing of sales could significantly bias prices.

The study does not properly account for the history of operation of the pit

The causal effect of a gravel pit on property values is not a simple step response (open pit, drop values). It results from a complex interplay of factors that evolve over time. For example, the opening of a pit may cause an initial drop in value for existing properties, which subsequently grows over time as surrounding properties are developed to lower standards, or as owners fail to maintain their properties (because it isn't worth it to do so, given their diminished values). To some extent, the decline in value may precede the opening of the pit, if neighbors anticipate expanded operations.

To properly treat such interactions (and others, known as endogeneity bias) requires consideration of the timing of home and pit development. Unfortunately, no such consideration has been taken in the Rygg study.

The Fairbanks review

The actual substance of the Fairbanks memo consists of a single paragraph, which simply restates the boundaries of the Rygg study, determines that it was complete, considers that price per square foot is an appropriate metric, and approves the adjustments made for lot size and improvements. It cannot be determined whether Fairbanks verified any of the data reported, except that it is noted that none of the properties were actually inspected. In particular, there is no evidence that Fairbanks checked the selection of comparable properties for bias.

In concluding comments Fairbanks quotes Rygg,

> "Mr. Rygg determined that "None (of the sales within the environment of the gravel pit) were influenced by the presence of an operating gravel pit."

So far as I can determine, this is not in fact an exact quote from Rygg's analysis, but it captures the essence of Rygg's conclusions. However, Fairbanks fails to note the limitations stated by Rygg on page 24, which are crucial to the interpretation of the results. An especially critical observation is that pit operations were transient:

> "The buyers said that they did not anticipate the possibility that the permits could be extended and the operations expanded *and would not have bought had they been aware of this possibility.*" (emphasis added)

This suggests that a possible reason for no adverse finding is the expected brevity of pit operations. It also clearly invalidates generalizations from the experience at the subject pits to other situations with longer duration of operation.

Rygg goes on to say,

> "The scope of this study is confined to the market's expectation of the level of pit activity and length of continued pit operation as of the date each subject transaction occurred. Underlying the conclusions of this report is the assumption that the operation of the gravel pits will revert to their 1994-1996 level of activity, that they will not continue to be as active as they were during the highway construction of 1997. *A continuation of this peak level of operation could eventually erode neighborhood property values, although existing market evidence is insufficient to validate such a hypothesis.*" (emphasis added)

Again, it is clearly incorrect to conclude from this study that other pit operations would have no influence on property values – in fact, Rygg suggests the opposite, though he correctly notes that the study is not informative on the topic.

Nevertheless, Fairbanks goes on to comment,

> "In the course of responding to valuation challenges of ad valorem tax appraisals, your reviewer has encountered similar arguments from Missoula County taxpayers regarding the presumed negative influence of gravel pits, BPA power lines, neighborhood character change, and traffic and other nuisances. In virtually ALL cases, negative value impacts were not measurable. Potential purchasers accept newly created minor nuisances that long-time residents consider value diminishing."

It is crucial to realize that this is merely Fairbanks' opinion. It is not supported by the Rygg report or any other cited evidence. If other attempts to measure negative impacts were as flawed as the Rygg study, it is not surprising that impacts were not found. However, failure to detect impacts using inferior methods does not prove that impacts do not exist (and extensive literature using proper methods indicates that they do, as above).

Citations in environmental assessments

As discussed in the previous section, it is incorrect to generalize from the Rygg study to circumstances elsewhere in Montana. Rygg himself pointed out a key limitation, unlikely to hold elsewhere: that buyers expected operations to be transient. Equally important, a study of a single locale is an absurdly small sample from which to draw statewide

conclusions. In any event, given the potential for selection bias and other technical issues, the most one should conclude from the study is that it failed to measure an effect (not that it measured a zero effect).

Lake Helena-Valley Drive & Keller Site

Citations of the study in the Lake Helena-Valley Drive Gravel Pit draft environmental assessment and the Keller Site final environmental assessment give a different impression. The Lake Helena draft EA states:

> 5. Property Values (EA Section 15)
>
> COMMENT: The operation will decrease property values in the surrounding residential area.
>
> RESPONSE: Sale or market value of adjacent property has not been shown to be negatively affected by the presence of a gravel pit and associated operations (Rygg 1998). In any case, under the Opencut Mining Act DEQ has no authority or jurisdiction over property value issues.

This gives the reader the impression that a concrete finding was reached, when the result should in fact be regarded as "no information". It also fails to note that the Rygg study is likely of no relevance to the Keller Site.

The Keller Site EA goes farther:

> 14. LOCAL AND STATE TAX BASE AND TAX REVENUES: Will the project create or eliminate tax revenue?
> Sale or market value of adjacent property may be negatively affected by the presence of a gravel pit, but DEQ has no specific information on this issue at this site. ...

So far, so good. Continuing a few sentences later,

> Several years ago, DEQ contracted a study to determine "whether the existence of a gravel pit and gravel operation impacts the value of surrounding real property." The study (Rygg, February 1998) involved some residential property near two gravel operations in the Flathead Valley. Rygg concluded that the above-described mitigating measures were effective in preventing decrease in taxable value of those lands surrounding the gravel pits.

Not so fast. Rygg assumed that mitigation measures would be taken as specified in the permit, but drew no conclusions about whether it was mitigation, transient operation, scale of operations, or any other feature of the pit or study methods that lead to an unmeasured decrease in value.

The EA goes on to quote the unsubstantiated Fairbanks memo (see previous section):

> In his review of the study, Jim Fairbanks, Region 3 Manager of the Montana Department of Revenue, Property Assessment Division said:
>
> "In the course of responding to valuation challenges of ad valorem tax appraisals, your reviewer has encountered similar arguments from Missoula County taxpayers regarding the presumed negative influence of gravel pits, BPA power lines, neighborhood character change, and traffic and other nuisances. In virtually ALL cases, negative value impacts were not measurable. Potential purchasers accept newly created minor nuisances that long-time residents consider value diminishing."

Finally, the EA adds its own conclusions, free of evidence and contradicted by basic economics:

> The proposed Keller mine and crushing facility and other operations in the area (Schellinger Tutvedt 2, Beasley Silverstone) create the possibility of reducing the attractiveness of home sites to potential homebuyers seeking a quiet, rural/residential type of living environment. These operations could also affect the marketability of existing homes, and therefore cause a reduction in the number of interested buyers and may reduce the number of offers on properties for sale. This reduction in property turnover could lead to a loss in realtors' fees, but should not have any long-term effect on taxable value of property. If homeowners believe their property values are decreased because of a gravel operation, they may appeal to the county and the state for tax adjustments.

The first half of this paragraph identifies the possibility of reduced attractiveness of homesites and marketability of existing homes, therefore reducing buyer turnover and offers. So far, this is consistent with common sense. It goes on to conclude, though, that somehow diminished attractiveness and demand "should not have any long-term effect on taxable value of property." This is uneconomic nonsense. All else equal, a reduction in demand and offers for any product will force a seller to either accept a lower bid or endure a longer waiting time (thus receiving less value in discounted terms). The best one could possibly hope for is that the decrease in value would be small.

Nuss Site & Morgan Family Site

The recent Nuss and Morgan Family Site draft EAs are a little more balanced, as they also cite Orville Bach's 2008 memo detailing impact findings of higher quality than the Rygg study.

However, like earlier EAs, they also state, "Based on Rygg's analysis and Fairbanks' review, sale or market value of adjacent property has not been shown to be negatively affected by the presence of a gravel pit and associated operations." While this is technically correct, the reader may draw the inference that, since no effect was found,

whatever true effect exists must be small. In drawing this inference, one presumes that the seeker has made a proper search. However, in this case, the nature of the search is likely to have involved looking in the wrong location for the wrong item.

Since the Rygg study is in fact deeply flawed, is not generalizable to other geographic areas and circumstances, and could easily fail to detect even a large effect, it should not be mentioned at all. Similarly, citations to the Fairbanks review, which is entirely unsubstantiated and contradicts common sense and a considerable body of literature, should simply be stricken from the draft.

A suggestive counterexample, and options for proper study

Because the conclusions of the Rygg report, Fairbanks memo, and EAs contradict common sense and a large body of literature, I wondered whether obvious effects of gravel pits could be detected using a more comprehensive survey of properties. As an experiment, I downloaded aerial photos and cadastral data (parcel boundaries and tax appraisals) from NRIS. I visually inspected several gravel pits in semi-rural areas of Gallatin County, looking for a suitable natural experiment, where a group of properties with similar physical attributes (e.g., lot size) were located at varying distances from a pit.

I quickly found the Rainbow Subdivision, which straddles Highway 191, south of Cobb Hill. Within that subdivision are two groups of twenty lots, identical in size. One block is located next to a gravel pit; the other lies on similar terrain across the highway. The median assessed value of improvements adjacent to the pit is $97,000. The corresponding improvements across the highway have a median assessed value of $120,000.

It is tempting to say that the effect of the pit is a $23,000 decline in property values over about half a mile. However, the actual situation is not that simple. The values used are computerized mass appraisals for tax purposes, and may not be reliable. Home values in the area no doubt coevolved with the operation of the pit over time, so timing should be taken into account. Other attributes, not evident from aerial surveys, may be important. Nevertheless, the Rainbow Subdivision strongly suggests that the real effects of gravel pits may differ dramatically from their portrayal in the Rygg and Fairbanks documents.

To properly evaluate the effect of gravel pits, one ought to take advantage of as much data as possible, by studying areas around a number of pits (avoiding the risk of generalizing from a single instance). Metrics, including land value, should be sought to complement price per square foot. Hedonic methods should be used to account for differing property attributes.[9] To disentangle time series effects, one would ideally seek natural experiments, where property values for repeat sales of homes could be compared before and after the opening of a pit. Survey methods could be used to capture amenity

[9] See for example EPA environmental economics research, at:
http://yosemite.epa.gov/ee/Epalib/ordl.nsf/be2a2fc6b757efdf8525655800003c00/db7c31617b004cd8852565a5006befa6!OpenDocument

and health effects, not fully reflected in real estate prices, which nevertheless may be significant.

Whatever method is chosen, it should include "ground verification." The fact that neighbors are vocally opposed to gravel pits, and expend substantial time and money to oppose them, should be taken as a clear sign of economic value at stake. A study that ignores, or fails to account for, the experience of neighbors hasn't really measured the full societal effect of gravel pits.