RESOURCE TECHNOLOGIES CORPORATION
248 E Calder Way, Suite 305, State College, PA 16801 814-237-4009 f: 237-1769
PO Box 242, State College, PA 16804 www.resourcetec.com

Valuation of Aggregate Operations for Banking Purposes
(Sand and Gravel and Crushed Stone)

Aggregate consists of sand and gravel and crushed stone. The principal consumers of sand and gravel and crushed stone materials are the highway and building construction industries. The principal construction uses include:

- Structural products - used in horizontal layer applications such as pavement construction for highways, parking lots, and other paved areas
- Drainage, filtration, and erosion control - used in construction of highways and parking lots, earth dams and building foundations, for treatment of wastewater, and for erosion control on slopes, channel protection, and shoreline protection
- Component of Portland cement concrete - used in the building construction industry
- Component of Asphalt concrete - used in highway construction

The basic qualities that are considered to represent the suitability of aggregate for specific use include resistance to abrasion and impact, absorption, and soundness. Basic specifications for aggregate include:

- Base material - The material placed between the compacted sub-grade below and the overlying asphalt cement or Portland cement concrete course(s).
- Asphalt concrete - Because aggregate comprises around 95% by weight of asphalt concrete, the characteristics of the aggregate have a significant effect on the properties and the performance of the resulting material. Important physical and mechanical characteristics of aggregate used in asphalt concrete include grading, particle size, angularity, and a generally low porosity.
- Portland cement concrete - Aggregate strength is important in the creation of Portland cement materials. Surface texture is not as important for Portland cement concrete as it is for asphalt concrete, although it can affect bonding to a degree.

Aggregate is typically divided into two components:

- Fine aggregate including sand – material passing a 3/8-inch screen sieve, essentially all passing a # 4 sieve (i.e., a 0.187-inch square opening).
- Coarse aggregate including gravel – generally considered being crushed stone or gravel, almost all of which is retained on a No. 4 sieve.

According to the United States Geologic Survey (USGS)[1], in 2012 nearly 6.5 tons of aggregate (construction-grade crushed stone and sand and gravel) was produced for every person in the United States. There are nearly 10,700 construction materials quarries and mines in the United States (4,000 crushed stone operations and 6,700 sand and gravel operations). Together, they produced more than nearly 2.2 billion tons of material (1.25 billion tons of crushed stone and 850 million tons of sand and gravel). As a result of the 2007/2008 recession, total aggregate production has fallen to its present levels from a high of nearly three billion annual tons in 2006.

In 2012, the national average selling price of construction aggregate was approximately $8.90 per ton FOB (freight on board - loaded on trucks at the mine):

- Crushed stone was $9.78 per ton – varying from roughly $4.00 per ton to nearly $20.00 per ton depending on location and grade of material
- Sand and gravel was $7.65 per ton - varying depending on location and grade from $3.50 per ton to more than $15.00 per ton loaded on trucks at the mine.

The average mine produces approximately 200,000 tons per year, with crushed stone mines producing an average of 350,000 tons per year and the average sand and gravel operation producing approximately 150,000 tons per year. There are mines in nearly every state; some states host large hard rock mines, and others host small sand and gravel sites. Larger operations may produce more than four million tons per year with sophisticated large scale mining and processing operations. The smaller operations may operate intermittently and use small scale or portable machinery and equipment. Many sites are coupled with heavy construction operations and may also host concrete (ready mix) and asphalt production facilities. Some sites may also accept demolition and other construction waste as fill for mined out areas and as enticement to attract customers.

Based on searches through various publications, more than 100 aggregate operations have exchanged hands during the last three years. Some of the operations involved one pit; some were reserves with no ongoing operations; and some involved multiple pits together with asphalts and concrete plants. Of the transactions noted only 25 actually published considerations; these amounted to more than $9 billion. It is difficult to use these or any mineral transactions as direct comparisons for valuation purposes. The best that can be done is to use them to get a feel for trends in the market.

As a low per unit value commodity, aggregate is typically mined and processed as close to the end user as possible. As an example:

> If the two largest aggregate quarries in the Chicago area were shut down, the $100 million worth of stone produced and sold annually within the area would have to be obtained from other mines located 50 miles farther away. Because of the cost of shipping, this would raise the cost at the point-of-use to nearly $225 million – a $125 million increase.

While the quality of aggregate is important, it is obvious that the value of aggregate

[1] http://minerals.usgs.gov/minerals/pubs/commodity.

material is tied closely to its proximity to the end user. Generally, aggregate is not shipped more than 35 - 50 miles from the excavation site to end users.

Because of the investment required for modern aggregate operations (time and capital), companies typically require a minimum of 15 to 25 years of reserves to open a quarry. In contrast, since sand and gravel operations do not usually require sophisticated and expensive crushing equipment, these sites may offer fewer years of reserves and still be attractive (7 to 15 years).

Establishing new mines has become exceedingly difficult. In general, proposed mine development generally engenders local opposition. This opposition usually increases where there is significant residential development. Opposition can delay or cancel mining or can result in additional restrictions being placed in the operating plans. Delays and restrictions raise the cost of mining. Cancellations raise the value of deposits that can be, or are, developed.

In short, mine and site value is determined by:

- Quantity of accessible material that meet specific engineering specifications
- Location of the site with respect to end users – highly densely populated areas use more material per square mile and per person
- Time and cost related to obtaining permission to operate
- Cost to produce saleable material
- Local competition.

For banking purposes, most mineral properties are valued as an active industrial property that contain raw minerals (coal, limestone, sandstone, gravel, etc.). Typically, the properties being appraised for banking purposes are being exploited or are planned to be mined for the ore. In addition, the sites generally include or have access to various facilities for crushing, sorting, and washing the stone products, as well as for weighing and loading the products and for testing product quality. A Highest and Best Use analysis is used to establish the basis for valuation and whether subjects are situated in an exploitable location allowing it to profitably serve local, regional, or national markets. In some cases, all or a portion of the site may not be suitable or profitable to initiate or continue mining. In this case, the site may contain excess land – land which offers more value for other legal uses.

In all cases, it must be determined if the subject's mineral reserves are an integral part of the subject value – like good soil is important to farming and frontage is important to a commercial land use, profitable access and use of the mineral is the key to the value of a mine. This determination can only be accomplished by completing a reasonable Highest and Best Use analysis:

- Is the mineral present in sufficient quantity to initiate and sustain production?
- Is it technically feasible to extract or to continue to extract the mineral? How thick is it? How deep is it?
- Is it legal to mine, continue to mine, or to expand the mine at its location? Are there mining restrictions which affect the efficiency of mining?
- Is it economically feasible to exploit the mineral at this location? What will it

cost to mine, process, and market the mineral? What can it be sold for? Is the market large enough to warrant investment? What are future capital requirements?

- Is this the most profitable use of the land? Is there excess land associated with the mine?

A mineral deposit has virtually no value if it cannot be economically (profitably) developed. The only appropriate analysis available to estimate a deposit's (mineral properties) value is to figure out if the deposit can be economically exploited. Generally, this requires analysis of:

- Potential cash flows
- Previous cash flows on the property and similarly situated properties
- Actual and/or hypothetical royalties
- Market conditions
- Physical attributes of the deposit and the site.

The appraisal of a mineral operation involves the analysis of a fairly complex set of components all oriented toward profitably of exploiting the site. The appraised value is generally broken out among the following integrated components:

- Fee Estate
  - Mineral/Land
    - Quarry mineral and land
      - Including support and buffer land
      - Reversionary or post mining land uses
    - Excess Land
  - Site Improvements
    - Structures
    - Fixed Equipment, such as Crushing and Screening Plants, Hot Mix Asphalt Plants, Concrete Plants, etc.
    - As permitted and improved for mineral extraction
- Machinery and Equipment
  - Hauling Trucks
  - Front-end Loaders
  - Excavators
  - Portable or Semi-Portable Plants, such as Crushing and Screening
  - Other types of equipment
- Working Capital
  - Inventory
  - Cash and Other Liquid Assets
- Intangible Assets
  - Business Value
  - Synergistic Values - Considered, but can't be calculated.
  - Other

Frequently, the fee estate (land and mineral) represents a smaller proportion of the total value, as calculated by the Discounted Cash Flow analysis, than the total of the machinery and equipment, working capital, business, and goodwill assets.

To complete the appraisal in accordance with the Uniform Standards of Professional Appraisal Practice, the appraiser needs to review financial, operational, and market information. The appraiser will likely review the following:

- At the quarry:
  - Development or confirmation of the estimate of volume of remaining material in-place that can be mined and sold in the market
  - A review of the quality of the material at the site
  - Estimation of the probable profitability of the operation given the location of the mine, the local land use, and the environmental situation – in short, determining the highest and best use of the site
  - Examination of the local/regional real estate market in order to understand the most likely post mining land use, timing, and value
  - Examination of the mining operation for efficiency and potential conflicts
  - A review of existing equipment concerning adequacy for continued operation and total expected life
  - Examination of liabilities such as reclamation and landfill maintenance

- Concerning the operation:
  - A review of the current and likely future market for construction materials within the market radius of the site/plant
  - Examination of the transportation advantages and impediments to the site
  - Comparison of the local/regional competitive sources of similar materials
  - Estimation of the likely profitability of the operation

To complete the appraisal, the appraiser should have access to various records including:

- Site maps/mine plans
- Pro forma(s), if available
- Income and expense statements (three years)
- Equipment lists and maintenance schedules, by operation
- Copies of geologic studies previously completed including records of drill cores completed, if any
- Copies of mine permits and permit applications
- Copies of union/labor agreements, if applicable
- Lists of major environmental or operational violations
- Copies of zoning and land use synergistic/agreements/consent orders
- Copies of chemical or physical tests completed of materials in-place, if any
- Copies of land deeds, agreements of sale, & previous appraisals, if available
- Lists of major customers (three to five years).

In general, three approaches – cost, market, and income – are available to estimate the value of any property. In one form or another, these approaches are based on the "principle of substitution." That is, a purchaser of a property would typically pay no more for one property than for another of similar utility. Utility and all aspects related to it are defined by the Highest and Best Use of the property being appraised.

However, unlike other properties, mineral operations are a depleting asset, i.e., the act of mining and generating cash flow results in the removal of the valuable asset. In fact, even the "land" itself at quarry sites is literally consumed (mined) by the income production process.

Mineral properties are purchased for the production of future income. In the marketplace for mineral properties, the "comparative sales approach" is given only limited credence. It is nearly impossible to directly compare one mine to another – deposits differ, ore grades differ, cost to mine and process differ, markets differ, etc. Adjustment to the sale price nearly always requires a detailed analysis of the income production of each property and the amount of the adjustment can vary widely. Instead, typical market participants use some form of an income approach to assess any potential development of a mine or determine a value of an existing operating mineral property or entity. In short, the reliance on the income approach is based on two factors:

- A mineral property is only useful to the owner if it can generate current or anticipated future income. The potential amount of that income, its duration, and its likelihood are typically measured in the market.
- Mineral properties are unique – each serving a differing market, each possessing differing mineral peculiarities, and each capable of supporting differing levels of development and production. The income approach to valuation provides for the examination of the unique characteristics of a site or operation.

In Mineral Deposit Evaluation, A.E. Annels, 1991, states succinctly that "In all but a few exceptional cases, an adequate financial return from a mining project is the essential criterion which must be fulfilled before an affirmative decision to exploit is taken . . . The vast majority of mineral exploitation projects are therefore undertaken for financial gain and the geological characteristics of the deposit are but one factor of many which collectively determine a project's profitability."[2]

Since it is the object of the appraisal to mimic or model the behavior of the marketplace, it is appropriate to focus on the income approach to determine the value of the mineral property. Paschall, in the Appraisal of Mineral Producing Properties[3], states that "a mineral properties' appraiser is first, last, and always, a mineral industries' economist." Similarly, in the Appraisal of Construction Rocks[4], he concludes:

---

[2]Annels, Alwyn, E., Mineral Deposit Evaluation, Chapman & Hall, London, 1991, pages 306-322.

[3] Paschall H. Robert, ASA, The Appraisal of Mineral Producing Properties, ASA VALUATION, American Society of Appraisers, 1974.

[4]Paschall, Robert, H. CPG-00118, Appraisal of Construction Rocks, 2nd, American Institute of Professional Geologists, Arvada, Colorado, 1998.

> "If the appraisal of an active pit or quarry is at issue, and the appraiser is told that local law permits appraisal only by reference to sales comparison, the appraiser should refuse the assignment."

> "The capitalized income method is the only method appropriate to appraise an active construction-rock operation."

According to Gentry and ÒNeil, a basic text in mineral property appraisals, "the preferred method for mining property valuation and the one universally used in the commercial practice is the income approach."[5] They go on to state:

> "Because mines have limited operating horizons and because there are well-established markets for mineral commodities, the income approach is widely used in valuing mineral properties. The approach is used commonly by the mining industry in assessing investment rates of return and determining appropriate **purchase prices for mines or mineral prospects**."[6]

The income approach is also referred to as the present worth of future benefits or the discount method. In this approach, an annual amount (net profit or annual royalty) is capitalized into a present value estimate. The approach assumes that a dollar in the future is worth less than a dollar in hand today. The assumption is based on the principle that money can earn income, that is, a dollar invested today can increase (i.e., interest) in value over time. The rate of the discount is based on estimates of:

- Expected inflation - Can be incorporated but the appraiser should generally use constant dollars. (If inflation is incorporated, the discount rate should also include inflation.) Incorporating inflation can artificially increase net income. Real growth should be identifiable.
- Opportunity costs – cost of money (i.e., What could an equal sum earn in other investments as debt and/or equity?)
- Risk (the chance that this investment will succeed as expected or fail).

The key factor in evaluating mining operations is that, unlike most other real estate investments, at the conclusion of mining, the asset will be gone. In the typical real estate investment cycle, at the conclusion of the investment period, the asset remains, there exists a reversionary value. In a quarry, there is a hole in the ground surrounded by a relatively small amount of buffer land. Frequently, quarries are located in rural areas, where the residual land exhibits little if any reversionary value. For the most part, the fixed equipment is used beyond normal depreciation and may exhibit only modest scrap value. Mining machinery is generally rubber-tired or track-machines that are moved from job-site to job-site. The investment cycle must therefore capture both the return of and the return on investment with expectation of significant reversionary or residual value.

---

[5] Gentry, Donald W. Dr. and O' Neil, Thomas J. Dr. Mine Investment Analysis, Society of Mining Engineers, American Institute of Mining, Metallurgical, and Petroleum Engineers, Inc. New York, New York, 1986, page 14.

[6] Ibid.

It is imperative that the appraisal is based on a detailed Discounted Cash Flow (DCF) rather than a simple capitalization of net income. Capitalizing net income, a technique used in some commercial appraisals, presumes constant or stable incomes and regular and predictable expenses and is based on the assumption of a near-infinite cash flow. Mining and mineral deposits do not follow that stable or predictable pattern. Mines will deplete, sometimes in the distant future and other times in a very short time frame. The DCF allows the appraiser to forecast future incomes and expenses which are not stable or annual such as capital equipment needs, changes in mining requirements, necessary site development costs, and major or unique demands for material, etc. Only the discounted cash flow can reflect this situation.

The appraiser is seeking a measure of market value, that is, the value which could be expected to be obtained if the subject of the appraisal were exposed to the open market. The appraisal is not simply the calculation of the unique investment value of the particular operation and management at this location. The financial statements examined should be detailed enough to allow comparison to industry statistics and they should represent a long enough time period to avoid the typical boom and bust cycles of national, regional, and/or local construction events. For example:

- Major regional construction projects, like highways or a large institutional or commercial projects, may temporarily inflate production volumes and prices. Ideally, the analyst should view five or more years of performance but in any case, no less than three years of data. Given the recent national construction boom from 2005 through 2007 and severe recession through 2013, a ten-year financial picture may be necessary.

- The appraiser may compare the subject mine to other similar operations known to the appraiser and to industry statistics such as those published by "Bizminer[7]" and "OneMine.[8]" It is essential to see if an operation, mine, or deposit is more or less expensive than other mining operations in regard to blasting, mining, crushing, screening, and, sometimes, washing of the material. Some rock, for example, is harder than other deposits to winnow from the earth; some rock is more wearing on equipment than other rock; some can create all locally required marketable sizes with little or no waste, other rock processes end-up with piles of unsaleable waste.

- General mining costs may be compared to typical mining costs from reviews of other similar mine operations, mining cost models developed by Aventurine Mine Cost Engineering[9], and construction cost data sources including Dodge Cost Manuals[10]. Selling and administrative costs are based

[7] http://www.bizminer.com/

[8] http://www.onemine.org/

[9] SHERPA, Aventurine Mine Cost Engineering, Elk, Washington, 99009

[10] Dodge Unit Cost and Heavy Construction Cost Manuals, Marshall and Swift Publishing, Mc Graw Hill, New York, New York, annual.

on typical mining costs from reviews of other similar mine operations, and construction cost data sources including Dodge Cost Manuals.

- Some portions of a mining cycle are more profitable than others. For example, every mine must expend time and money to expose the desired rock, this may only occur episodically, a normally profitable operation may lose money during the year that clearing and site-prep occurs. Focusing on financial statements that only cover a few years may not capture the complete mining cycle and, depending upon the portion of the cycle covered by the information, may result in either under or overvaluing the operation. In the same regard, if the analyst does not recognize future mining requirements, the result will be an overvaluation of the mine.

- As an operation mines deeper, costs may increase. At depth, water may be encountered, requiring pumping and water control or requiring mining under water. Deeper and larger mines require long haulage systems which can be expensive. Mine expansion may therefore require a different cost structure and thus a different valuation model.

- Operations that use onsite diesel generators to create electric current to run processing and may, therefore, exhibit significantly higher costs than those that use electricity from the utility power grid to run the plant. This factor must be taken into account when reviewing and comparing historic income and expense statements. The same is true for Hot Mix Asphalt plants. In today's energy market plants, plants that heat asphalt with natural gas have a significant cost advantage over those that burn fuel oil for heat.

- As the operation nears its completion, it must prepare to close when operations terminate. Local and state requirements will control how the site must be closed. Depending on the requirements and the current mining situation, this may or may not represent a significant liability.

- Mining equipment wears out. A long-term Discounted Cash Flow (DCF) is used to model these future expenses. A review of equipment depreciation schedules, hours used/maintenance schedules, a view of the operating equipment, and a discussion with the operator, can aid in predicting these future costs.

- Income is generated by the sale of the product. The income and expense statement should allow the appraiser to see how much is transferred internally to the owner's asphalt, concrete, or construction business and how much is sold on the open market. Owner operators may internally transfer commodities such as stone at retail, at cost, or at some other value. The appraiser must, based on the scope of work, determine what the appropriate price/income structure is before completing the appraisal.

To summarize, based on the scope of work, the appraiser must build the DCF model based on a determination of:

- Local/regional demand
- Market prices
- Realistic mining and processing costs
- Future factors affecting cost and production.

In most banking situations, there are two appraisal goals:

- Determine the overall enterprise value and cash flow of the operation:
  - Will it be successful?
  - Can it generate a cash flow to pay back the loan?

- Determine the value of the (mortgageable) fee estate:
  - Mineral/Land
    - Quarry mineral and land
    - Support and buffer land
    - Reversionary or post mining land uses
    - Excess Land
  - Site Improvements as permitted for mineral extraction
    - Structures
    - Fixed Equipment, such as Crushing and Screening Plants, Hot Mix Asphalt Plants, Concrete Plants, etc.

The value of the total operation is the net present value of the operational DCF. In-place mineral\land value can be difficult to extract from the overall value. Generally, two methods are available. The first is to calculate a Residual Value from an analysis of the total value. In this procedure, the known or market values of the other components of value are subtracted from the total value, i.e., total value less the value of:

- Buildings and structures
- Working capital and inventory
- Machinery and equipment
- Realistic entrepreneurial profit.

The second method is to assume that the mineral/land would command a royalty of rent from an operator. In many situations, the land and mineral are owned by some other entity than the mine operators. In these instances, the operator pays a royalty to the mineral land operator for every unit of material mined and sold from the property. This royalty is frequently calculated as a fixed amount per ton or as a percentage of the selling price. In either case:

- It is generally paid when the material is mined and sold – so it is part of a DCF calculation.
- Royalties are common enough that rates and amounts can be extracted from the market – making the valuation of the mineral market-based rather than residual to the total DCF.

Most texts suggest that presumed royalty value be assigned to the mineral as though the operation were exploiting minerals owned by a third party. This assumption allows the appraiser to look to the market for royalty rates similar to the way the land appraiser looks to the market for sales and leases. Using this method, the present worth of the presumed royalty income stream is calculated. This value represents an estimate of what the operator would pay to a third party to use the equipment at the site to mine the mineral, therefore, producing a profitable income stream. Since, in the quarry situation, the mining consumes the land as well as the mineral, presumably the royalty represents the real value of the mineral in-place as real estate. The royalties typically paid for limestone and other aggregate sources vary from mineral type, location, ease of mining, and the local market. Surveys show that royalty rates are higher in the urban areas than in the rural areas.

Having determined a royalty value, the appraiser can now separate the components of value based on market indicators:

- Total Value – operational discounted cash flow
- Land and Mineral – royalty approach
- Excess Land – comparative sales
- Reversionary Value – delayed realization of land values derived from comparative sales
- Fixed Machinery and Equipment – comparative sales of installed replacement equipment that will serve a similar use
- Rolling Stock (mining and hauling equipment) – comparative sales of replacement equipment that will serve a similar use
- Inventory and Working Capital – market surveys of typical amounts required for the business area
- Excess Inventory – site specific examination.

Cost documents for the new equipment and sources such as “Top Bid” and “Machinery and Equipment Trader” for used equipment are typically used to determine a range of probable auction prices of machinery, equipment, and rolling stock items. Cost documents such as “Marshall and Swift” are often consulted for building values. However, it must be emphasized that since this is an appraisal of an operating entity, the appraiser is using these as source guides. The valuation of the capital assets is related to the “as-is” nature of the operating business. With an eye to the auction trade value and the equipments condition, a portion of the overall operational value is really allocated by answering questions such as:

- Do the items serve their function?
- Do they contribute to the operation?
- Is there any excess or deficiency?

By this method, the business and intangible values become the residual calculation, i.e., the total value less all of the market derived components. The business value represents the entrepreneurial interest – the value of assembling, at some risk, the machinery and equipment, personnel and management, and marketing and finances at the subject location. However, this process does not recognize that a portion of this business value actually remains with the land. A portion, sometimes a large portion, of the “business value” is related to the fact that the land area is permitted and zoned to allow mining and is improved and opened for mining.

It can be exceedingly difficult to obtain permission to mine at any location. This permission generally goes with the land. While the miner may be required to obtain a license – it is the site which is permitted to host a mine. Like a residential land development site that has been approved for subdivision development, when a permitted mining operation is sold, it is sold as permitted and developed. Therefore, a portion of the "business" or residual value calculated above should be assigned to the fee estate (mineral/land). According to Carroll and Watkins[11]:

> "Corporate acquirers are prepared to pay a premium for sites with large proven, permitted, and zoned reserves, extending cash flow generating ability. Expansion oriented aggregate producers are confronted with two choices. The first choice is to establish a Greenfield site, in which timing and total costs may be unknown variables in the equation. A firm may invest significant dollars over several years and still not have a viable operation. The second choice is to purchase an existing site(s), with predictable production for a defined period of time (reserve life), immediately generating cash flow over the reserve life."

> "The difference between the two choices is obviously the risk associated with each. Total proven and probable reserves are estimated by using geological surveys and drilling definition holes. The size and the amount of capital equipment, including shovels, dozers, haul trucks, crushers, screens, and other ancillary equipment, combined with estimated weather and maintenance downtime, will determine annual production levels. Knowing the reserve amount and the annual production rate determines the remaining reserve life. The greater the reserve life, the longer and more predictable the cash flows are, and a greater acquisition value assigned."

The value of a permitted site in a rural area far removed from neighbors in a municipality with no zoning is generally the cost of the search efforts for land, permit application, plant design, air quality permits, and highway occupancy permits, all typically completed by a consulting firm with oversight from a company representative. Some municipalities request building permits for anything on a foundation, such as plant equipment, scale houses, and scales. The total cost before the purchase of the plant may exceed $250,000. Extensive public hearings, which are generally standard, will increase this cost. In difficult situations, the costs to obtain permits and zoning approval may exceed $1,000,000.

If the site lies in a municipality that has zoning or other land use controls, then additional work is needed. Most sites are granted permission by Conditional Use. This involves a formal request for the proposed land use, which is invariably followed by a public hearing. In order to get to this level, most municipalities need to make sure the operation is serious about the request and expect the company to have the appropriate permits submitted to any and all state level governing bodies. Even with this level of commitment, there is no guarantee that a Conditional Use Permit will be granted.

The last point to consider is the time value of the permitting process in today's "NIMBY" (NOT IN MY BACK YARD) world. Even when good sources of aggregate are known to exist, the NIMBY attitude makes it very difficult to open new quarries.[12] The time

---

[11] Carroll, T. M., and Watkins, W. P., January 2000. Mining higher aggregate company values. U.S. Bancorp, Piper Jaffray, p. 18.

[12] Bilec, Dr. Melissa; Marriott, Dr. Joe; Fernanda; Padilla, Maria; and Snyder, Dr. Mark, Market Analysis of Construction Materials with Recommendations for the Future of the Industry, Pennsylvania Department of Transportation, University of Pittsburgh, January 14, 2010, Page 25.

needed to complete this process is usually two years; in a worst case scenario, the time delay may be extended to a five or seven-year process and may need to be repeated at multiple locations (an operator may be denied a few times). The more urban the area, the longer it will take to get a green field site permitted and the greater the chance that a Conditional Use Permit will be denied.

The addition of an asphalt plant to the quarry can further complicate the approval process. Municipalities are reluctant to grant Conditional Use Permits for asphalt batch plants. According to a white paper published by the Engineering and General Contractors Association, the siting of asphalt operations is significantly affected by the NIMBYism. Even when permits are granted, the encroachment on the asphalt operations by local development causes the manufacturing businesses to continually mitigate the conditions granted through the permit. According to the paper, “ultimately, costs become imbalanced, hours of operations are reduced, and the availability and supply of affordable materials have vanished from the community.”[13]

Kris Wernstedt, an Associate Professor of Urban Affairs and Planning at Virginia Tech, conducted a study in 2000 on the perceptions of the general public in regard to aggregate operations. Interviewees were asked to assign their perception of the degree of local opposition into categories ranging from “never any” to “always.” The categories of “always,” “usually,” and “often” were judged to represent significant opposition to the operation. Fewer than 20 percent of the respondents reported significant local opposition to existing operations, whereas an average of 75 percent reported significant opposition to proposed new operations. The respondents suggested that community reaction appears to vary relative to the size, nature, and location of the operation.[14]

The value of the <u>in-place permits</u> can be based on:

- The estimated cost of obtaining permission to mine – engineering and legal expense. Like any other site improvement, the value of these expenses will be passed on from owner to owner and thus included in a perspective sale price.

- The value of the time delay related to purchasing or leasing alternative land, preparing the mine permit application, and obtaining the permit from local and state agencies. Based on surveys, this time period is assumed to be at least two years and could be significantly higher based on regional market conditions. In short, this value is based on the loss income related to delaying the operation’s cash flow.

The in-place permits for the operation of the mine and associated plant facilities are tied to the land. Therefore, the value of delay is an additional bonus attributed to the land as a value above and beyond the present value of the royalty stream. In essence, this is

---

[13] EGCA White Paper, FINAL 11/11/04 The Impending Asphalt Plant Crisis, Engineering and General Contractors Association, www.egca.org.

[14] Robinson, Gilpin R and Brown, William M., Socio-cultural Dimensions of Supply and Demand for Natural Aggregate – Examples from the Mid-Atlantic Region, United States, U.S. Geological Survey Open-File Report 02-350, page 22.

the bonus value a mining company would pay for the permitted site. This amount is then subtracted from the residual business value and added to the value of the fee estate (land and mineral).

In short, a site that is ready to “rock and roll” is worth more than a site that is not. In an operating site, this enhancement is only partially estimated from the cost of site permitting, preparation, and development. The site’s largest value component may, in fact, derive for the delay in net income that must be endured until a virgin site can be permitted. For example, recently a permit was granted to a limestone quarry in Pennsylvania. Salient information used to value the quarry operation are summarized below:

- A 400-acre quarry contains at least 30,000,000 tons of mineable / saleable limestone.
- Based on the market study, the quarry is expected to mine approximately one million tons of stone per year for at least 30 years at an average selling price of $9 per ton; producing $270 million in gross income over the life of the mine. No inflation is assumed.
- Even though the operator owns the site, a 6% royalty is assumed for allocation purposes. Market research of similar operations serving the same region that mine comparable material is used to establish the likely royalty rate. This assumes that the royalty allocates $16,200,000 to mineral and land over the life of the mine.
- Mining, on-site haulage, crushing, washing, selling, scale and loading, reclamation, and administrative costs are estimated at $6.50 per ton. No inflation is assumed.
- Net Operating Income (NOI) after all costs and royalty allocation is $2.44 per ton. Yielding $73,200,000 total income over life of the operation.
- Pretax discount rates with inflationary expectations removed are:
  - 10% for the royalty interest – a passive interest with little or no capital and/or expense risks.
  - 15% for the royalty interest – an active interest reflecting capital, forward expenses, and management risk.
- Discounted cash flow is calculated as a midyear discount, reflecting the ongoing continuous nature of expenses and income.
- A $6 million crushing and washing plant is in place and mining machinery used to extract rock is worth approximately $2 million.
- The legal and permitting expenses are $1.5 million. The permitting effort is estimated to take three years which will delay the realization of income for three years.

- No start-up or ramp-up time is assumed. The site is assumed to sell one million tons during the first year of operation.

- Residual value following closure of the mine is based on the sale of the modest amount of buffer land surrounding the water-filled pit; averaging a net, after selling costs, of $1,000 per acre or $400,000 realized during following the last year of mining (year 31).

- Land restoration is expected to require the expenditure of $1,000,000 or $2,500 per acre. This expenditure also is anticipated to occur during the year following closure (year 31).

Given these assumptions the present value of net cash flow is estimated to be $20,907,885 (PV of Royalty plus PV of NOI). This total is not the value of the mortgageable interest. The mortgageable interest is identified through the allocation as follows:

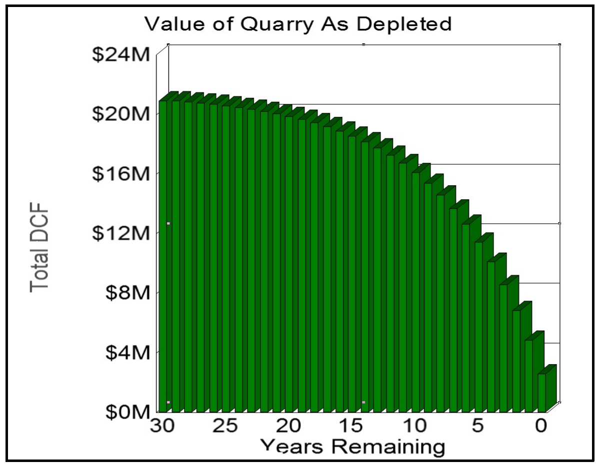
Allocation of Value							
Total DCF as calculated					**$20,907,885**		
Allocation							
By Component of Value						**Tons in-place**	**Acres**
						30,000,000	400
Land & Mineral	Royalty & Residual Land	$5,360,854					
	Permit/Zoning Cost		$1,500,000				
	3-year Delay of Royalty income		$1,333,165				
	Subtotal			**$8,194,018**		$0.27	$20,485
M & E	Plant	$6,000,000					
	Mining Equipment	$2,000,000					
	Subtotal			**$8,000,000**			
Operating Capital	Working Capital		$1,800,000				
	Inventory		$552,500				
	Subtotal			**$2,352,500**			
Liabilities not included in operating costs				**$0**			
Subtotal					**$18,546,518**	**$0.62**	**$46,366**
Business Value (Subtraction of allocated & tested values from total DCF)					**$2,361,367**	**$0.08**	**$5,903**
Total					**$20,907,885**	**$0.70**	**$52,270**

In the example above, the mortgageable fee simple real estate value is $8,194,018. The balance of the as-is, as operating value ($12,731,866) involves inventory, operating capital, machinery and a equipment, as well as intangible business values.

It should be noted that in some instances the calculated residual that is allocated to business and intangible value may be negative. This value may be subtracted from the royalty calculation and the machinery and equipment estimates. This negative adjustment is a reflection of market conditions and can be considered as an adjustment for super adequacy and economic obsolescence. Should these adjustments result in extreme low values (e.g., adjusted land and mineral below raw land values and/or adjusted equipment values below auction values), the appraisal is telling the analyst to explore liquidation. This site does not support the continued or intended use.

Ultimately, following completion of the research and the characterization of the site, the commodity, and the market, the final formula is reduced to the sum of the expected period future cash flows discounted to a present worth. As always, the estimate of value is only as good as the data supporting the estimation. Where data is lacking or where the operations data is tied to an integrated operation, the analyst uses reasonable approximations based on research and experience.

Since the total value is the sum of the remaining discounted cash flows, as the rock resource is depleted, the value is reduced. Since the value is the sum of the remaining discounted cash flows, the amount is recalculated at each interval. Using the example quarry, the effect of depletion on overall value is shown in the adjacent graph (Value of Quarry as Depleted). The allocation to the Mineral/Land and Machinery and Equipment will follow this pattern. The allocation to the working capital and business enterprise will not.



A detailed site visit and management review is essential. During the site visit the appraiser gets to see how the operation is run – is it in good working order or is it sloppily maintained? While on-site, the appraiser can see if the equipment is well maintained and if it matches the task at hand – is it too big, too small, etc.? The site visit also affords the appraiser the opportunity to discuss the deposit, mining problems, competition, market factors, staffing, and other factors that affect value. Lastly, it is important to at least drive-by and look-over the local competition – comparing mining techniques, amount of material in stockpiles, number trucks on-site, amount of activity, apparent reserves remaining, as well as access to transportation (truck, rail, or barge). The site visits and comparisons are referenced by the appraiser when making subjective evaluations that make up a large part of any appraisal.

Finally, the market survey should also include a search for likely buyers. There tends to be two types of buyers: 1) local interests with a project or projects in mind or who desire to augment a local operation and 2) national and, more recently, international interests who attempt to cover territory and to control market share. The local buyer frequently requires significant capital and loans to complete the transaction. These smaller operations tend to lack some of the data required to easily complete an analysis. Therefore, the appraiser of the smaller operation takes more time to collect information and to analyze the information provided. In contrast, many of the larger operators maintain excellent detailed income and expense statements, detailed mining and geologic records, and are aware of finance and appraisal needs. Most important, the larger operations typically assign professional personnel to assist the appraiser in gathering data.

The following is a list of many of the factors typically considered when completing a mineral appraisal (coal, aggregate, and other minerals):

1) Geographic Location	
Location:	proximity to towns, supply depots, markets, etc.
Topography:	access to property, access to mineral deposit
Climatic conditions:	months of operation
Surface conditions:	vegetation, stream diversion
Political boundaries:	land use issues, i.e., zoning
2) General Geologic	
Mineralization:	type, grade, uniformity
Geologic structure:	geometry and size of deposit --complexity of mining
Rock:	physical properties
Overburden	
Stratigraphy	
Drainage patterns	
Seam or deposit thickness	
Overall depth of deposit	
Physical characteristics of mineral:	grade, chemical characteristics, variability
3) Nearby and Likely Exploitation Activities	
Regional activities:	types, success, history
Similar deposits/reservoirs	
4) Environmental Factors	
Likely constraints to exploitation	
5) Nearby and Site-specific Exploration	
Historic:	district and property
Current program	
Reserves:	tonnage, distribution, classification
Sampling:	types, procedures
Proposed or likely exploitation program	
6) Governmental Considerations	
Taxation:	federal, state, and local
Reclamation requirements	
Operational requirements	
Zoning	
Proposed mining legislation	
7) Transportation	
Property access	
Product transportation:	methods, distance, costs
Location of rail, highway, and/or pipeline systems	
Capacity of rail, highway, and/or pipeline systems	
8) Market Characteristics	
Marketable form of the product:	concentrates, ore, specifications of product
Proximity to markets	
Market location and alternatives	
Expected price levels and trends:	supply demand, competitive cost levels. new source of substitutions and tariffs

9) Utilities
- Electric Power Availability
- Location
- Natural gas: availability, location, costs
- Alternatives: on-site generation potential
- Rights-of-Way

10) Water
- Potable and process: sources, quality, quantity, availability, cost
- Mine water: quality, quantity, depth, source, drainage method, treatment

11) Land and Mineral Rights
- Ownership: surface, mineral, acquisition and/or option costs
- Acreage requirements: mine, preparation, concentration location, waste sites, tailings sites
- Competing, restraining surface uses
- Principal lease terms
- Reliability of titles, patents, and mapping

12) Literature Review
- State geologic survey
- Industry publications
- USGS publications
- USBM publications

13) Production Data
- Historic production at site (5 to 10 years in today's market).
- However typically 3 to 5 will work
- Intended future production
- Anticipated production changes (technical, management, economic)
- Anticipated production anomalies
- Intended market (proportion historic, new, fixed or contracted, open or spot)
- Maximum capacities
- Minimum thresholds
- Quality parameters of output (flexibility of equipment and market)

14) Financial Data
- Discount rates expected: likely market requirements for capital
- Historic profitability
- Balance sheets and profit and loss statements for at least 3 years
- Tax returns for at least three years
- Current market conditions
- Financial requirements of similar industries: risk factors, equity ratios, dividends, yields, etc.