

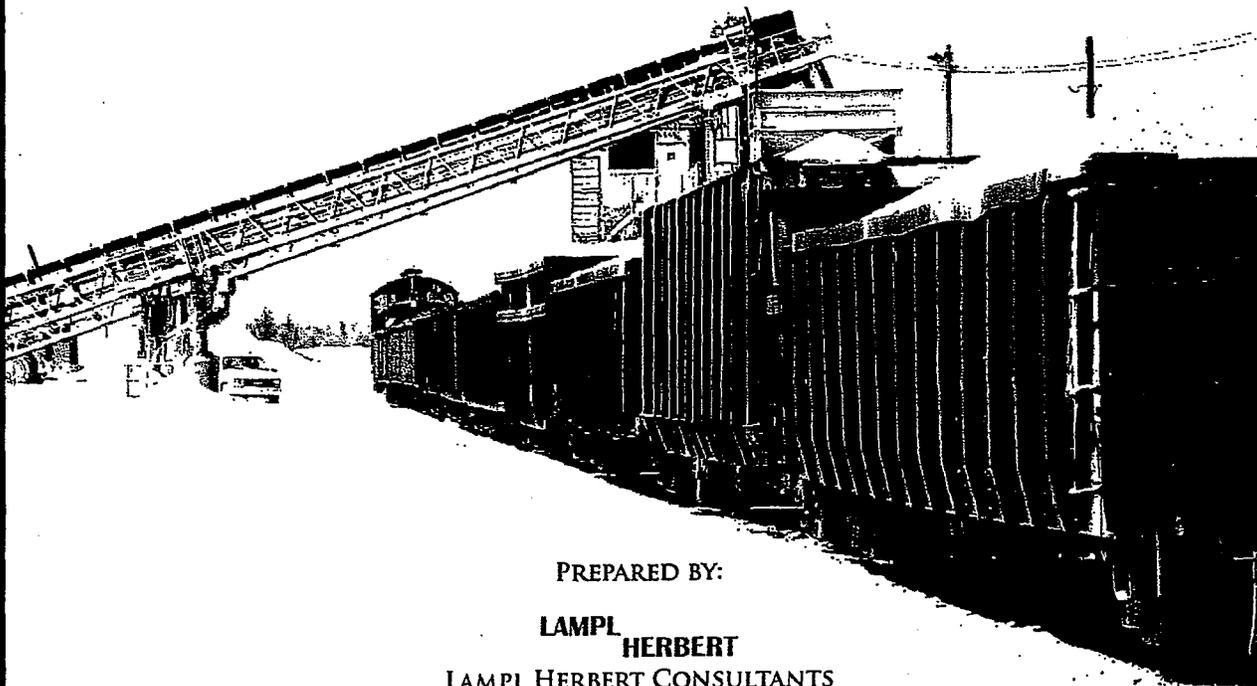
STRATEGIC AGGREGATES STUDY:  
SOURCES, CONSTRAINTS, AND  
ECONOMIC VALUE OF LIMESTONE  
AND SAND IN FLORIDA

PART I

IDENTIFICATION OF SOURCES OF MATERIALS  
AND CONSTRAINTS

PART II

POTENTIAL IMPACTS TO THE  
FLORIDA ECONOMY FROM THE  
AGGREGATE PRODUCTION



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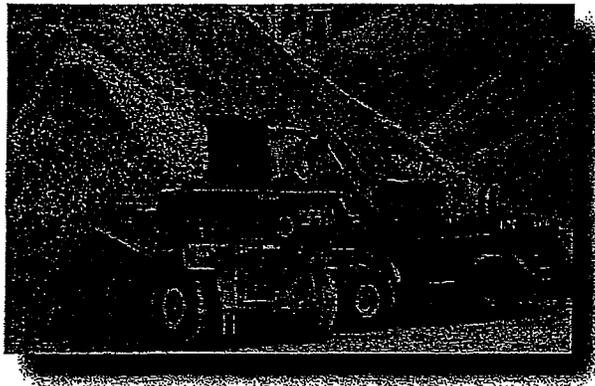
MARCH 12, 2007

FINAL REPORT

**Strategic Aggregate:**

"Strategic"... Highly important to or an integral part of a plan ...

"Aggregate" ... Crushed stone and high quality sand mined and processed for construction of roads, bridges and buildings.



The Florida Department of Transportation has undertaken a study to document the importance of aggregates materials and to evaluate ways to assure the quantity and quality of materials essential to the economic well-being of the state. Aggregates are the crushed stone and high quality sand mined and processed for construction of roads, bridges and buildings. The activities associated with mining, processing and transportation of aggregates and crushed stone materials are an integral but often overlooked part of the economic activities in the state.

Limestone and sand mined for aggregate materials are found in relatively small resource areas in deposits defined by geologic conditions. High quality deposits of limestone are "place based" in the sense that we cannot choose where these deposits are found but to a large measure we can choose where land development occurs. However, the mining industry in the state is increasingly constrained by surface development.

The economy of Florida consumes an estimated 143 million tons of aggregate materials each year. Approximately, 120 million tons are produced from mines in the state, 8

million tons are imported from U.S. domestic sources, and 5 million tons are imported internationally. Florida is successful in recycling and 10 millions tons are re-used each year. The Miami Limestone formation found along southeast coast in the Lake Belt Region of Miami-Dade County is the hardest and most durable geologic formation available in the state. Approximately 55 million tons of rock from this area is processed in to aggregate products each year and provides the main supply source for the entire construction industry. There are five "mega-mines" in the Lake Belt that provide this majority of this material. These mega-mines are among the top ten in production in the country; the first and second ranked mines are in the Lake Belt.

An integrated rail system moves Lake Belt materials to markets in Orlando and Jacksonville. At least five other limestone formations and a significant area of quality sand are found at the surface around the state in defined regions. They provide another 65 million tons from more than 100 smaller and geographically dispersed mines. These smaller, regional mines use truck hauling to move products to market.

The Florida Department of Transportation is the single largest contractor for aggregate materials through its construction and maintenance programs. The department also is the standards-setting entity for how the engineering properties of these materials are set established and tested. In this regard, the department is speaking on behalf of these strategic materials in almost any context or forum, whether county or municipality.

There are problems on the horizon in the aggregates supply chain. For example, existing mining permits have been challenged in the Lake Belt. The output from sources around the state continues but the quality is declining for many engineering purposes. Florida limestone formations outside the Lake Belt are generally not as high in quality. Both large and small land developments are over-running the lands where limestone and sand deposits are found. Local land use decisions fueled by homeowner and neighbor's complaints have made planning and permitting new mines extremely costly or impossible. Even expanding existing mines is impossible in some areas because the reserve lands have been hemmed in by development. The mega-mine complex in Lee County has seven years of remaining capacity and when it closes, the aggregates that it supplies to all of southwest Florida will need to be trucked in from other locations at a much higher price.

The economic review conducted in the study looked at the near-term issues related to a federal lawsuit that potentially could shut down production from the Lake Belt. The study also evaluated the economic impacts of mine closures in other parts of the state because of depletion or other causes. Any scenario that causes shut down of production from the Lake Belt will have serious economic consequences beginning within 30 days. The worst case modeling for a complete shut down of Lake Belt mines places the statewide total annual impact at \$28.6 billion in lost economic output, \$11.2 billion in lost wages, and loss of 288,000 jobs primarily in the development, construction, and real estate sectors. Modeling has also predicted that losses of even 5 percent of production of aggregates materials from regional mines annually will have significant and cumulative impacts because replacement is not often available within the existing supply chain.

This study has put in focus the challenges for the near term. The agenda is clear.

- In-state aggregate reserves are inadequate to provide for growth in the five to ten year period as major suppliers face continuing regulatory delays;
- Regulatory deliberations should consider the place-based nature of the aggregate and crushed stone resources and their strategic importance to the economy ... changes will be required to reflect this;
- Florida's dependence on the Lake Belt as a single source makes the economy vulnerable to any supply chain disruptions ... diversification is needed ... sources need to be developed in Florida and other areas;
- Port capacities will need to be expanded and upgraded to handle a 5-10 fold increase in aggregate shipments;
- Multimodal improvements in the supply chain are required to achieve efficiencies in rail, truck, and waterborne transportation; and,
- New ideas for public/private funding should be examined to provide for these infrastructure needs.

The next steps should include a review of this agenda and the supporting materials by policy makers and stakeholders. A good forum for this seems to be a task force appointed to review and study the issues. The results of the task force deliberations should be presented as recommendations to the Governor, the Legislature, and the Transportation Commission by November, 2007.

## INTRODUCTION

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The State of Florida is the 3<sup>rd</sup> largest consumer of crushed rock products in the United States. The Florida road-building and construction industries are expected to consume 143 million short tons of crushed stone in 2007<sup>1</sup>. If projections hold, construction of new homes and buildings may require 86 million tons of crushed stone -- almost half of those materials will be used to meet the housing needs of a rapidly expanding population. Forty-two million tons of rock will go to construction of roads, bridges, runways, and other infrastructure, making the Florida Department of Transportation (FDOT) the largest single contractor/user of crushed stone resources in the state.

Crushed stone in Florida is produced from limestone, which is mined or extracted from naturally occurring deposits found in 22 counties. Approximately 93 percent of crushed stone material used by the road-building and construction industries in Florida is mined within the state; 43 percent of this total comes from an area known as "the Lake Belt" in Miami-Dade, Southeast Florida, because of the characteristics of the rock resource. Nearly 55 million tons of limestone will be produced from 10 Lake Belt mines in 2007.

Some 8% of the rock materials used in Florida are imported from domestic (Georgia and Alabama in 2007) and 5% from offshore (Mexico, Canada, and Bahamas) sources; the remaining materials are produced by recycling aggregate or rock and used exclusively for road building.

Florida limestone is a strategic resource for the construction and maintenance of Florida highways, roads, and structures. Trends in local land use regulations, environmental issues linked with active mining, and a recent federal court decision regarding the Lake Belt district now threaten ready access to the in-state supplies of the rock resources that support Florida's transportation and construction industries.<sup>2</sup> Imported rock carries higher costs associated with shipping and handling.

### The Study

The FDOT initiated research in 2006 to address the current and future availability of crushed stone for building roads. The investigation looked at issues related to the location and quality of the rock formations that are presently mined throughout Florida to produce crushed stone materials for in-state markets. The research was designed to identify issues and impediments associated with development and recovery of crushed stone reserves statewide and the economic dimensions of the crushed stone market in Florida. The inquiry also considered the risks associated with dependence on mines in the Lake Belt Region.

<sup>1</sup> Part II of this report provides a detailed review of the data sources and the research methods used to aggregate production and consumption in the state.

<sup>2</sup> The terms crushed stone and crushed rock are used interchangeably in this report to describe rock materials that are removed from the ground by mining, then crushed and processed into size categories for construction purposes. Florida mines produce crushed rock that is sorted by screening into coarse and fine aggregates, which is the highest quality in the crushed stone categories. Florida rock is also used to create a crushed product called "limerock" that is used primarily for road base and specialty fill applications. Mines also produce natural silica sand for use in Portland cement concrete, concrete blocks, golf courses, and a variety of other uses.

The results of the research are presented in this report. Section I considers the resource *in situ* and examines issues associated with the quality the resource and with the context of human expectations and values. Section II was prepared by ECONorthwest in cooperation with LHC and focuses on the economic considerations associated with crushed stone material needs state-wide with special emphasis on the Lake Belt Region of Miami-Dade County. The economic analysis consider the effect of a shut down in the Lake Belt area and economic scenarios that anticipate increases in the importation of rock to meet the needs of Florida's road-building and construction industry.

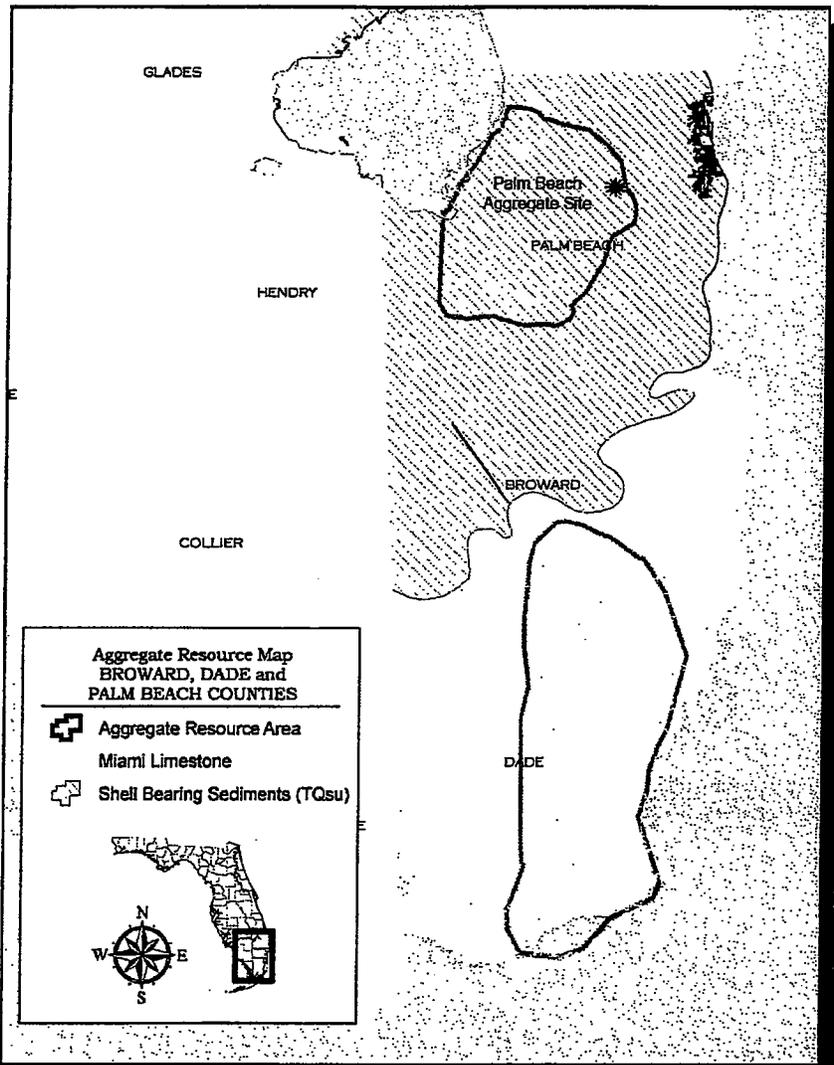
The research was conducted over an 11-month period between March 2006-February 2007. A wide range of stakeholders contributed to the study including representatives of mining companies, environmental organizations, shipping interests, representatives of local government (municipalities and counties), and state agencies. The data gathering process included survey research, individual interviews, site visits, and workshops. Key findings and recommendations are presented below.

### **Key Findings**

- Judicial decisions may limit access to the highest quality limestone in Florida;
- Mine expansion permits are routinely challenged and seriously delayed;
- Local governments consider or invoke moratoria on new mines;
- Residential developments, particularly large Developments of Regional Impact (DRI) in rural counties impinge on existing mine operations and limit options for expansions or new mines;
- Land use categories commonly associated with local government comprehensive plans may not be compatible with place-based resources such as limestone;
- Quality of rock available outside the Lake Belt Region for many engineering applications is declining;
- Identified aggregate reserves in Florida do not appear adequate to produce 150 million tons per year for 5-10 year growth period and beyond;
- Infrastructure for increasing imports – either by rail, barge or ship -- is not in place, and
- Florida is heavily dependent on resources from a single area: the Lake Belt of Miami-Dade County.

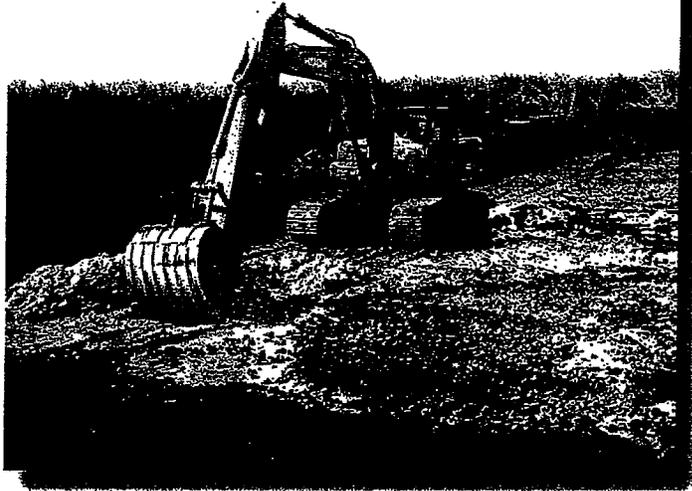
### **Preliminary Recommendations**

- Regulatory changes will be needed to continue to mine existing reserves efficiently and cost effectively;
- Florida needs to consider limestone from a statewide perspective;
- Port capacities will need to be increased 5-10 fold, and
- Rail infrastructure improvements and additions will be needed to handle imports and efficient intrastate distribution of aggregates.



**Figure 31: Limestone resource areas in Palm Beach (and Miami-Dade) County**

**Figure 32: Excavation for a test mine on sugar cane land in western Palm Beach County**  
(Source: LHC)



## BACKGROUND AND SUMMARY OF FINDINGS

In 2004, approximately 43 percent of all the crushed stone mined in Florida came from one small area — the Lake Belt region, which is between Miami and the historic Everglades. This region contains abundant amounts of high quality limestone that can be mined efficiently and delivered throughout much of the state cost effectively.

Crushed stone or rock is the most common form of construction aggregate and an essential material to Florida's economy. It is used to construct new roads, buildings, utilities, and other basic infrastructure. Adequate supplies of crushed stone are also critical for the repair and maintenance of existing structures.

Although often thought of as an ordinary and uniform commodity, there are actually wide variations in the quality of crushed stone. A given grade of rock might be usable in one application but not another because of differences in its physical and chemical characteristics. For example, if rock has to provide underlying support, such as in road base and concrete support structures for buildings, high quality crushed stone with strong physical strength is required. Similarly, such a material is necessary for paving heavily traveled roads so that the surface is able to resist wear for many years and minimize skidding.

By virtue of its geology as discussed in Section I, Florida has an abundance of soft limestone that is unsuitable for many construction needs in the state. The limestone found in the Lake Belt region is unusual because it is considerably harder and stronger than most of the rock found in elsewhere in Florida. Because of the unusual characteristics of Lake Belt crushed stone, about half of the material that had been used by the FDOT in the past 40 years had come from the region.<sup>1</sup>

On March 22, 2006, the U.S. District Court entered an *Order on Motions for Summary Judgment*, which called into question the continued prospect of mining in the Lake Belt region in Miami-Dade County, Florida. As an addendum to an on-going study of aggregate resources, the Florida Department of Transportation asked the Tallahassee based firm Lampl Herbert Consultants to expand the work to assess the effects and risks a cessation of mining in the Lake Belt would have on the economy of Florida.

To assist in the analysis Lampl Herbert Consultants engaged ECONorthwest to quantify the dimensions of the crushed stone markets statewide and the economic impacts a cessation of Lake Belt production would have. The study also evaluated the impacts of the "depletion effects" arising from other mines shutting down throughout the state as reserves are used up.

### Data Reliability

Data reliability is always an issue when researching crushed stone markets. Mining companies are highly competitive and are reluctant to share price, reserve, and production information in normal times. The continuing litigation in the Lake Belt put an additional cloak over industry data sources. Indeed, recognizing this situation the mining industry in Florida was not asked to offer any such data for this report.

<sup>1</sup> Wood, R. *Amicus curiae brief of State of Florida, Department of Transportation*. April 2006. Page 3.

Instead, this analysis relies primarily on construction statistics and other data considered reliable to ascertain crushed stone consumption in Florida. These data allowed the analysis to forecast the economic impacts of various outcomes of mine production curtailment in the Lake Belt and to evaluate the depletion effects statewide irrespective of the Lake Belt litigation. However, the absence of highly accurate regional pricing data and reserve figures precluded a full assessment of the probabilities of some scenarios.

The construction data approach used here came from F.W. Dodge, a division of the McGraw Hill Corporation. They maintain a database of public and private construction contracts for all counties in Florida and around the country. Through known relationships between the amounts of crushed stone used in different types and sizes of construction projects, F.W. Dodge is able to estimate the bulk of crushed stone consumption in Florida through various data sources. The base year was 2004 for this study.

ECONorthwest estimated the remainder of crushed stone use, which consists mostly of materials used in manufacturing, forestry, farms, and on small construction projects not captured by F.W. Dodge. ECONorthwest also accounted for the use of recycled aggregate—a contributor to market supply—and crushed stone contained in manufactured concrete products.

To verify the reliability of the construction data approach, a second method was used, which calculated apparent consumption from the perspective of supply. Apparent consumption of crushed stone was estimated by compiling reported production, import, and export data, and factoring estimates for recycling and inventory changes. For this method, production data from the U.S. Geological Survey ("USGS"), which does rely on mining industry reporting, the U.S. Census (a source of international trade statistics), the Association of American Railroads (for out-of-state rail shipments), and the U.S. Corps of Engineers, which collects waterborne shipments from domestic sources, were used.

Data sources for domestic rail and barge deliveries into Florida combine crushed stone with other mineral product shipments such as sand and clay. It was estimated that 60 percent of these shipments were composed of crushed stone. The amount of these shipments was estimated to be less than five percent of statewide supply in 2004, although the information was from less robust sources than other data

The Florida Department of Revenue's Office of Tax Research Mine provided production data for the Lake Belt. Labor data came from the U.S. Department of Labor and the Florida Department of Labor and Employment Security. State mine price data was taken from USGS reports. Import prices for crushed stone were derived from international trade statistics reported by the U.S. Census.

## **Major Findings**

The major finding of the analyses presented here is the appreciation of the sheer magnitude and importance of the Lake Belt mines to Florida's economy. Sudden cessation of production would damage the economy of Florida and, even after alternatives supplies develop, the losses would continue having an adverse effect on economic activity and the number of family wage jobs available in the state for a decade in all likelihood. Therefore, if there are to be closures, a gradual shift may allow

time for the development of comparable new supplies and help mitigate the negative economic consequences that would otherwise burden the state, especially if the alternatives come from in state sources.

Specifically, among the major findings of this economic analysis are:

- The size and market reach of the Lake Belt mines is far more extensive than typical crushed stone mining districts in the United States. This is clear evidence that most alternative in-state sources are both less efficient and produce lower quality crushed stone. Thus, the loss of Lake Belt production would result in a major and long lasting disruption to the state's economy.
- In 2004, the construction industry in Florida directly consumed 130+ million tons of crushed stone materials, which also includes about 10 million tons of recycled aggregate. For all uses, over 139 million tons were consumed in the state.
- In 2009, if production is allowed to continue, mines in the Lake Belt are forecast to produce about 55 million tons of crushed stone, which would be about 46 percent of statewide output.
- There are several alternatives to Lake Belt production, but all have significant limitations. Finding replacements for Lake Belt rock and reducing demand would be especially challenging for Florida and fraught with risks. The ten mines in the Lake Belt produce as much material as 80 average mines in the rest of the state. Very little hard, durable limestone is found in other mines in Florida and the great majority of mines produce none at all. Thus, the Lake Belt production cannot be replaced by higher production from other mines in state without a major mine development program through expansions of existing mines, creation of new and larger mines and rail infrastructure improvements. Building new mines in sufficient numbers to replace the Lake Belt is highly unlikely. Even if good deposits could be identified, finding communities in Florida willing to have large new mines built near them would be problematic.
- The most ominous scenario would be one where a complete closure of the Lake Belt happens suddenly and the marketplace has little time to adjust. As shown in this scenario, the burden of shortages of crushed stone would fall on the construction industry. Annual losses to the economy in such a situation would exceed \$28.6 billion, cost over a quarter million jobs, and reduce labor income statewide by \$11.2 billion. Although such economic damage would gradually be overcome as new supplies come onto the market, new mineral developments have historically occurred slowly over several years, and are subject to legal and financial challenges. Thus, severe economic losses would likely persist **for a decade or more**, which would be followed by lesser, yet significant continuing losses because imported crushed stone is both more expensive than Lake Belt rock and represents a drain of dollars out of the state's economy.

- Even in a short-term shut down scenario of 15 days (amounting to about 5% of Lake Belt production) for construction activity to decline enough (in year 2009 production) to compensate for the curtailment of even five percent of Lake Belt production, the analysis reveals that Florida's economy would experience over a \$2.4 billion loss in economic activity and loss or temporary layoffs of 24,627 jobs in that year.
- A scenario was run where regional mine production outside of the Lake Belt declines 5% (from where it would otherwise be in the base year of 2009) and is replaced with imported crushed stone. The reduction by 5 percent equals 3,226,188 tons of lost materials output for Florida, which would be worth over \$22.5 million. To replace the lost output, the state could import rock, which would cost about \$5.6 million more a year, an increase of 28%.