Frac Sand – New Volume Impact

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About PLG Consulting

Boutique consulting firm with team members throughout North America

• Established in 2001
• Over 90 clients and 250 engagements
• Significant shale development practice since 2010

Practice Areas

• Logistics
• Engineering
• Supply Chain

Consulting services

• Strategy & optimization
• Assessments & best practice benchmarking
• Logistics assets & infrastructure development
• Supply Chain design & operations
• Hazmat training, auditing & risk assessment
• M&A/investments/private equity

Industry verticals

• Energy
• Bulk commodities
• Manufactured goods
• Private Equity

Partial Client List

Frac Sand – New Volume Impact
Today’s Topic…New Volume Impact on Frac Sand Supply Chain

- Large supply growth over past 3 years with consolidating number of players - capital strength is key for future
- Demand growth curve has been building for past 12 months - upward trajectory just beginning
- Sand pricing under increasing pressure - already up 5 - 25% depending on grade
- Unit train shipping will become a more common practice in the near future - velocity and asset efficiency are as important as rail pricing
- Trucking market remains regional and disaggregated - will again be challenged with rapid growth
“Old” techniques increased productivity by 10-20% increments (2011~2013)

- More well bores per well pad
- Zipper wells
- Longer lateral lengths
- Zone fracturing

“New” high intensity techniques producing 25-100% productivity increases

- Inner “perf” distances reduced by half
- Large increases in stages per well – up to 80!
- Sand per lateral foot – 2X to 5X
- Slickwater technique enables higher sand intensity
- Some are reducing or eliminating ceramics

Despite additional cost for sand per well, NPVs are increasing by up to $2MM per well; ROR up 40%

Source: Marathon, February 2014
Mark R. Williams—VP E&P, Whiting Petroleum on Bakken wells (May 1, 2014):

"Last March, we changed our frac design. We essentially went from 1.5 million pound sand volumes up to 7 million pound sand volumes. When we did that, the equation changed out here. And so, since that time, our drilling has really concentrated in this area where we are in Razor and Horsetail and Wildhorse. But with these three additional locations on the east side and the three on the west side – I should say northeast side and three on the west side, we’re really going to extend the reservoir with this new frac design. That’s really the idea here is to see how it performs."
“Follow the Leaders”

Industry leaders are enjoying 25-75% increases in 30-, 60- and 90-day production rates with latest fracking techniques.

“Fast followers” are adopting industry leaders’ new completion techniques including changes in amounts and mesh sizes of frac sand used.

Rate of change is accelerating in order to capture improved yields and secure most productive mesh sizes capacity.

Message for frac sand industry is RAPID GROWTH!
E&P companies have two levers to impact well performance: increase frac conductivity or reservoir contact area

- Frac conductivity is a function of strength, uniformity in size and shape, and thermal stamina and requires higher-quality proppant, including ceramic
- Reservoir contact area requires a large volume of finer-mesh sand to provide maximum coverage

Due to smaller grain size, 100-mesh exhibits improved reservoir contact area properties vs. traditionally-used sand

100-mesh sand is now a high-demand product for many well engineers

- Until recently was a “waste” product
- Huge, recent growth demand growth – more to come with fast followers
- Led to recent price pressure due to supply/demand situation

The reservoir contact area approach is now producing the best yield (higher production with optimized total cost) for a growing number of operators

"(We) see a clear pathway to the volume of sand demand that's out there doubling or tripling in the next four to five years."
- US Silica Chief Executive Bryan Shinn (Reuters, 9/19/2014)
Hydraulic Fracturing Materials Inputs and Logistics Involved

Materials
- Frac Sand
- OCTG (Pipe)
- Chemicals
- Clean Water/Cement

Source to Transloading
- Local source
- 35~100+ Railcars
- 25 ~ 100

Transloading to Wellhead Site
- 100 ~ 400
- 20
- 8
- ~1,000
- ~1,200 Total Truckloads

Transloading to Wellhead Site
- 5

Waste Water
- ~500 Total Truckloads

1 Unit train of sand = 100 railcars = 10,000 tons = 20,000,000 pounds

Oil/Gas/NGLs
- Truck, Rail, Pipeline
Frac Sand Deposit Locations

Recent new mine announcements in WI, IL, MO

Most desired sand comes from WI, MN, IL

MO has momentum

More interest in OK recently
Major Sand Shipping Flows
Frac Sand Handled by Railroads

Load data suggests ~30% growth in past two quarters alone

Quarterly Data

STCC 14413  Source: US Rail Desktop

Frac Sand – New Volume Impact
Updated Processed Sand Total Delivered Cost per Ton

“Benchmark” unit train example – Illinois to South Texas

- Single-line haul (one rail carrier)
- Private railcars
- Railcar fleet achieving two round trips per month
- Origin sand facility has direct rail load-out
- Destination trucking is less than 100 miles

Unit train operations include efficient origin/destination handling

- 24 – 36 hours per train

Manifest service would increase rail-related costs by 17%

- Increased freight rate (12% higher)
- Railcar fleet only achieves one turn per month, on average
- Additional trackage required to accommodate larger fleet
- Delivery patterns are more variable, requiring additional destination storage and inventory

Total Delivered Cost per Ton ~ $127

Logistics costs drive ~63% of total delivered sand cost

Source: PLG analysis using BNSF public pricing – does not include fixed assets at origin or destination
Current average sand price per ton = $47
Sand Railcar Market Conditions – Small Covered Hoppers

Current market is “red hot”
- Increased frac sand per well demand, liquid rig count up 10% YTD
- Additional sand sources opening in Wisconsin
- New orders from cement shippers and plastic pellet cars

Availability is well into 2016 (18-24 month lead time) – 24k unit backlog

Typical full service lease rates $600 - $650

Frac sand shippers/receivers will continue to move towards more efficient methods of rail transportation
- Manifest shipments require 2X the number of railcars vs. unit trains due to increased cycle times
- Use of manifest service usually encourages use of railcar as storage at destination, further increasing fleet requirements

Cement consumption is expected to grow by 6%+ in 2014 and 2015, encouraging railcar orders

Small covered hoppers compete with large hoppers for capacity – 8k plastic pellet car backorder
# Frac Sand Supply Chain Has Numerous Challenges and Opportunities – Now and Near Future

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### Frac Sand – New Volume Impact

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**The frac sand “gold rush” times of ‘11 are back again!**

**Biggest risk? - oversupply of light crude depressing prices and slowing drilling – 2015~?**

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**Questions:**

- What are the primary challenges faced in the mining/processing step?
  - 100-mesh capacity...sand quality

- What is the challenge in the rail load-out step?
  - Unit train loading capability...access to competitive rail

- What is the challenge in the rail step?
  - Rail system performance...congestion in WI, ND, TX

- What is the challenge in the transload/storage step?
  - Unit train unloading capacity...becoming sales “storefront”

- What is the challenge in the trucking step?
  - Regional challenges will continue...especially with new volumes

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**Challenges and Opportunities:**

- Step 1: Mining/Processing
  - 100-mesh capacity...sand quality

- Step 2: Rail Load-out
  - Unit train loading capability...access to competitive rail

- Step 3: Rail
  - Rail system performance...congestion in WI, ND, TX

- Step 4: Transload/Storage
  - Unit train unloading capacity...becoming sales “storefront”

- Step 5: Trucking
  - Regional challenges will continue...especially with new volumes

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**Important Notes:**

- The frac sand “gold rush” times of ‘11 are back again!
- Biggest risk? - oversupply of light crude depressing prices and slowing drilling – 2015~?
Thank You!

This presentation is available at:
www.plgconsulting.com/category/presentations

For follow up questions and information, please contact:

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