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2011

5-26-2011

SLIDES: The Economic Benefits of Completing Initial Reclamation Successfully for Oil and Gas

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Citation Information

Chenoweth, David; Holland, David; Jacob, Gerald; Kruckenberg, Lindsey; Rizza, John; and Whiteley, Bryan, "SLIDES: The Economic Benefits of Completing Initial Reclamation Successfully for Oil and Gas" (2011). *Best Management Practices (BMPs): What? How? And Why? (May 26)*. <https://scholar.law.colorado.edu/best-management-practices-bmps/10>

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THE ECONOMIC BENEFITS OF COMPLETING INITIAL RECLAMATION SUCCESSFULLY FOR OIL AND GAS

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INTRODUCTION TO CASE STUDY APPROACH

INTRODUCTION

Storm water management and proper reclamation is viewed as a direct cost of energy production.

CASE STUDIES

Until the upper management in energy companies understand what an adequate reclamation budget is, there is great risk that environmental staff will not be granted adequate budgets for successful initial efforts.

DISCUSSION

All of us as environmental professionals realize that our efforts in reclamation and stormwater management do not add to the bottom line profitability and stock value for energy development. However, we can add to the bottom line when our consulting and contracting efforts are on track and geared towards successfully completing initial reclamation.

CONCLUSION

Environmental coordinators and contractors have an obligation to maintain accurate annual cost data that tracks the cost for:

SITE PHOTOS

- Adequate budget for successful reclamation
- Cost of repair for failed reclamation

INTRODUCTION

CASE STUDIES + COST DATA

CASE STUDIES

- **Assesses** varying successes of reclamation and stormwater management efforts

DISCUSSION

- **Pioneer Natural Resources**
 - Study Area = Raton Basin, Trinidad, CO

CONCLUSION

- **Encana Oil and Gas**
 - Study Area = Piceance Basin, Rifle and Rullison, CO

SITE PHOTOS

- **Cost analysis** – Based on in-house records from Encana and Pioneer Environmental staff, Actual bids from Western States Reclamation, Inc. and contract amounts for work completed

INTRODUCTION

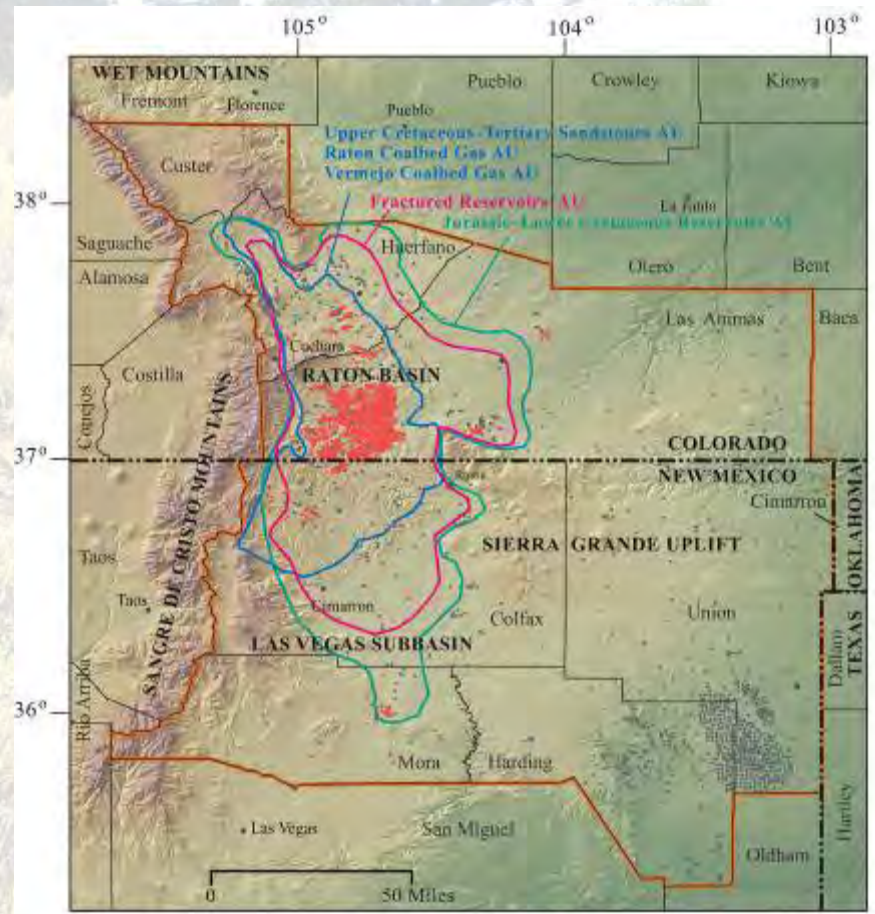
CASE STUDIES

DISCUSSION

CONCLUSION

SITE PHOTOS

SITE LOCATIONS



Pioneer Natural Resource Study Area = Raton Basin, Trinidad, CO
(Figure USGS)

INTRODUCTION

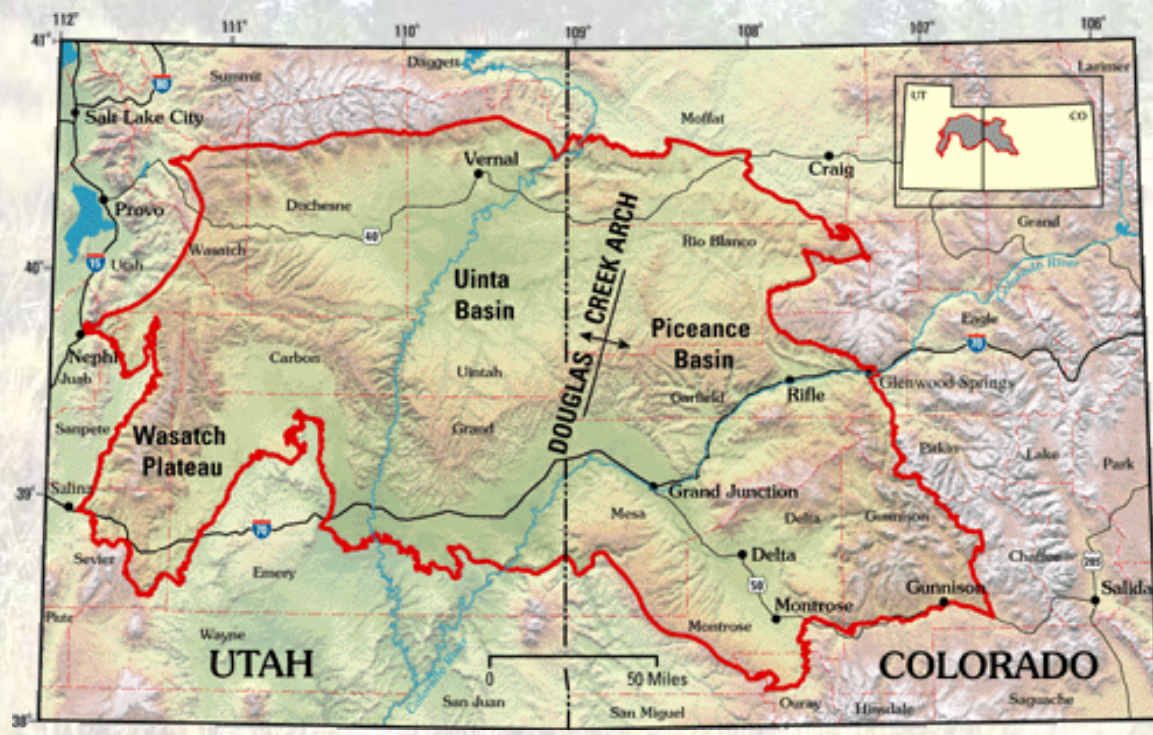
SITE LOCATIONS

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Encana Oil and Gas Study Area = Piceance Basin, Rifle and Rullison, CO
(Figure USGS)

INTRODUCTION

DISCUSSION

CASE STUDIES

- **Round Table** – Encana, Pioneer and Western States Reclamation

DISCUSSION

- Poor initial reclamation = Increased Lease Operating Expenses

CONCLUSION

- Establish list of key factors for successful reclamation projects

SITE PHOTOS

- Commonly associated direct costs
- Commonly associated indirect costs

KEY FACTORS FOR SUCCESSFUL RECLAMATION

INTRODUCTION

- **Site Inventory + Analysis**

- Locate facilities and access roads to minimize slope and stormwater runoff
- Soil Inventory
- Vegetation Species Inventory
- Drainage Basin or Watershed Information
- Noxious Weed Inventory
- Analysis of Inventoried information

CASE STUDIES

DISCUSSION

CONCLUSION

- **Identify areas for potential topsoil salvage and establish a replacement plan for interim and final reclamation**

SITE PHOTOS

- **Grade pads and install terraces, berms, benches, etc. to reduce sediment loading during interim and final reclamation**

- Geomorphic landforming and earthen hydrological controls

- **Apply the proper types and amounts of soil amendments to the soil when topsoil is lacking or poor quality**

- Organic fertilizers and humates used on both Pioneer and Encana sites with success. Cost effective and easy to apply by broadcasting or mixing in hydromulcher

INTRODUCTION

KEY FACTORS FOR SUCCESSFUL RECLAMATION

CASE STUDIES

- Perform proper soil tillage to loosen compaction

DISCUSSION

- Design proper seed mixtures and application rates
 - Adapted and native grasses, forbs and shrubs
 - Post Disturbance land use (ie. wildlife habitat, livestock grazing)
 - Number of total seeds per sq. ft.
 - Balancing seeds per sq. ft.

CONCLUSION

SITE PHOTOS

- Install and maintain BMPs and erosion control devices until the desired vegetation achieves self sustaining cover
- Maintenance and monitoring program that includes complete mechanical and chemical weed control

INTRODUCTION

KEY FACTORS FOR SUCCESSFUL RECLAMATION

CASE STUDIES

- Seeding Method Selection

- Drilling

DISCUSSION

- Broadcast

CONCLUSION

- Hydroseed

SITE PHOTOS

- Aerial Seeding

- Dozer broadcasting and slope tracking

- All broadcast seeding raked or harrowed into soil



INTRODUCTION

KEY FACOTORS FOR SUCCESSFUL RECLAMATION

CASE STUDIES

• Mulch and Erosion Control Fabrics Selection

- Innovation in FGM, BFM, ECM
- Straw/Hay
- Hydromulch
- Combination of Mulch and Structural



DISCUSSION

CONCLUSION

SITE PHOTOS

• Structural BMP Selection

- Erosion Logs
- Silt Fence
- Sediment Tubes
- Erosion Control Blankets



	PIONEER		ENCANA	
	Steep Slopes	Moderate Slopes	Steep Slopes	Moderate Slopes
Soil Amendments	Biosol + Humates @ 2,000lb/ac	Biosol + Humates @ 2,000lb/ac	Sustane 3.7.2 (Microrhizae + Humates) @ 2,000-3,500lb/ac	Sustane 3.7.2 (Microrhizae + Humates) @ 1,500-2,500lb/ac
Erosion Control	N/A	N/A	Erosion Control Logs 9" Excelsior. Used to contain and direct runoff/sediment	Erosion Control Logs 9" Excelsior. Used to contain and direct runoff/sediment
	N/A	N/A	Sediment Tubes 9"-12" Sediment Tubes. Used to contain and direct runoff/sediment	Sediment Tubes 9"-12" Sediment Tubes. Used to contain and direct runoff/sediment
Earth Shaping	Planning and siting of sites to more closely fit the natural topography	Planning and siting of sites to more closely fit the natural topography	Maintaining existing drainages with earthshaping. Concentrating flows into created swales armored with erosion control protection. Taking into account natural slope and aesthetics.	Maintaining existing drainages with earthshaping. Concentrating flows into created swales armored with erosion control protection. Taking into account natural slope and aesthetics.
Mulch	Bonded Fiber Matrix	Certified Weed Free Straw Crimped + Tacked	Flexible Growth Medium - Flexterra @ 3,000lb/ac	Certified Weed Free Straw Crimped + Guar Tackifier. Exposed slopes and areas sometimes tackified with light application of Flexterra.
Erosion Control Blankets	N/A	N/A	Double Net Straw Biodegradable Blanket + Flexterra Infill	Double Net Straw Biodegradable Blanket



INTRODUCTION

MONITORING AND MAINTENANCE

CASE STUDIES

MAINTENANCE

DISCUSSION

- WSRI wrote and is implementing an Independent contractor monitoring, recommendation and maintenance program for oil and gas

CONCLUSION

- Recognizing soil condition and inadequate amendments

SITE PHOTOS

- Recommendations to aid in vegetative establishment (Watering, Additional Amendments, etc.)

- Prompt weed control

- Contractor becomes responsible for oversights

INTRODUCTION

MONITORING AND MAINTENANCE

CASE STUDIES

MAINTENANCE

DISCUSSION

- Weed Control
 - Mechanical – Bush hog, weed eaters, hand pulling
 - Typically used in 1st growing season and completed 2 times
 - Chemical applications
 - Control when 20% canopy cover is achieved

CONCLUSION

- Touch-up Seeding

SITE PHOTOS

- After first growing season - 2 Seedlings per sq. ft minimum or touch up seeding must occur
 - Touch up seeding accomplished by broadcast and hand raking in small areas or drill interseeding in large areas.
- BMP Repairs
 - Regrading
 - Addition of more BMP's when needed

COMMONLY ASSOCIATED DIRECT COSTS OF RECLAMATION FAILURES

INTRODUCTION

CASE STUDIES

DISCUSSION

CONCLUSION

SITE PHOTOS

- Retrieving sediment from erosion and sediment events, including off-site
- Replacing sediment or other suitable materials in washout areas
- Regrading
- Reseeding
- Replacing and adding BMPs



INTRODUCTION

COMMONLY ASSOCIATED DIRECT COSTS OF RECLAMATION FAILURES

CASE STUDIES

- Extending the duration of weed management activities

DISCUSSION

- Additional maintenance and inspection costs

CONCLUSION

- Between Pioneer and Encana the costs are estimated to be between \$13,000-\$43,000 per acre.

SITE PHOTOS

INTRODUCTION

COMMONLY ASSOCIATED INDIRECT COSTS

CASE STUDIES

- Increased staff and consultant time

DISCUSSION

- Oil and Gas Environmental Staff or private consultants approximate rates are \$100.00 per hour. Thus several thousand dollars could be wasted easily in dealing with poor reclamation and erosion issues

CONCLUSION

SITE PHOTOS

INTRODUCTION

COMMONLY ASSOCIATED INDIRECT COSTS

CASE STUDIES

- Tarnished agency and landowner relationships

- What kind of price tag do you put on production delays due to challenging relationships?



DISCUSSION

CONCLUSION

SITE PHOTOS

- Potential regulatory and non-compliance

- What are the potential costs associated with fines?



INTRODUCTION

CASE STUDIES

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SITE PHOTOS

<i>Table 1 - Estimated Costs of Proper Reclamation Practices on Drill Pads</i>				
	EnCana - Piceance Basin		Pioneer - Raton Basin	
	<u>(2.1:1 to 3:1)</u>	<u>(1:1 to 2:1)</u>	<u>(2.1:1 to 3:1)</u>	<u>(1:1 to 2:1)</u>
<u>Treatments</u>	Cost per Acre	Cost per Acre	Cost per Acre	Cost per Acre
Lifespan Planning	\$950 to \$1,150	\$950 to \$1,150	\$1,250 per acre	\$1,500 per acre
Topsoil Conservation	\$525 - \$1,142	\$450 - \$1,101	\$750	\$1,000
Topsoil Replacement	\$1,100 - \$1,060	\$950 - \$1,020	All Inclusive, Drill Seeding w/ straw mulch, tackifier, BMPs \$14,000	All Inclusive, Hydroseed w/ Flexterra hydromulch, BMPs \$17,000
Pad Regrading	\$1,224 - \$1,632	\$1,224 - \$1,632		
Landforming	\$9,500.00	\$9,900.00		
Soil Preparation	All Inclusive, Drill Seeding & Crimped Straw \$2,620.00	All Inclusive, Broadcast Seeding & Flexterra Mulch \$7,015.00		
Soil Amendments				
Seeding				
Mulching				
BMP's	\$900.00	\$900.00		
Weed Control	\$125.00	\$200.00	\$125	\$200
Total Costs	\$16,944 to \$18,129	\$21,589 to \$22,921	\$16,125	\$19,700

INTRODUCTION

Cost Impact of Sloping Sites

CASE STUDIES

Encana

- Price Increase of %21 for steep slope reclamation (2:1 and over)

DISCUSSION

Pioneer

- Price Increase of %19 for steep slope reclamation (2:1 and over)

CONCLUSION

SITE PHOTOS



INTRODUCTION

CASE STUDIES

DISCUSSION

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SITE PHOTOS

Table 2 - Estimated Costs of Low Budget Reclamation Practices on Drill Pads

<u>Treatments</u>	EnCana - Piceance Basin		Pioneer - Raton Basin	
	<u>(2.1:1 to 3:1)</u>	<u>(1:1 to 2:1)</u>	<u>(2.1:1 to 3:1)</u>	<u>(1:1 to 2:1)</u>
	Cost per Acre	Cost per Acre	Cost per Acre	Cost per Acre
Initial Planning	\$520 to \$570	\$520 to \$570	\$1,000	\$1,000
Topsoil Stockpiling	\$775	\$625	none	none
Topsoil Replacement	\$1,350	\$1,250	none	none
Pad Regrading	\$1469 to \$2122	\$1469 to \$2122	\$1,000	\$2,000
Subsoil Contour Grading	\$11,100	\$10,750	none	none
Soil Preparation	none	none	minimal	minimal
Soil Amendments	none	none	none	none
Seeding	\$500	\$500	\$500	\$500
Mulching	none	none	none	none
BMP's	minimal non-structural	minimal non-structural	minimal non-structural	minimal non-structural
Weed Control	\$250	\$400	\$250	\$400
Total Costs	\$15,964 to \$16,667	\$15,514 to \$16,217	\$2,750	\$3,900

Large cost variability between Encana and Pioneer is based upon....

Encana

New staff hired specifically to address reclamation procedures and reduce associated fines.

Pioneer

Environmental staff still working with low and inadequate budgets.

INTRODUCTION

Costs Associated With Unsuccessful Reclamation Programs

CASE STUDIES

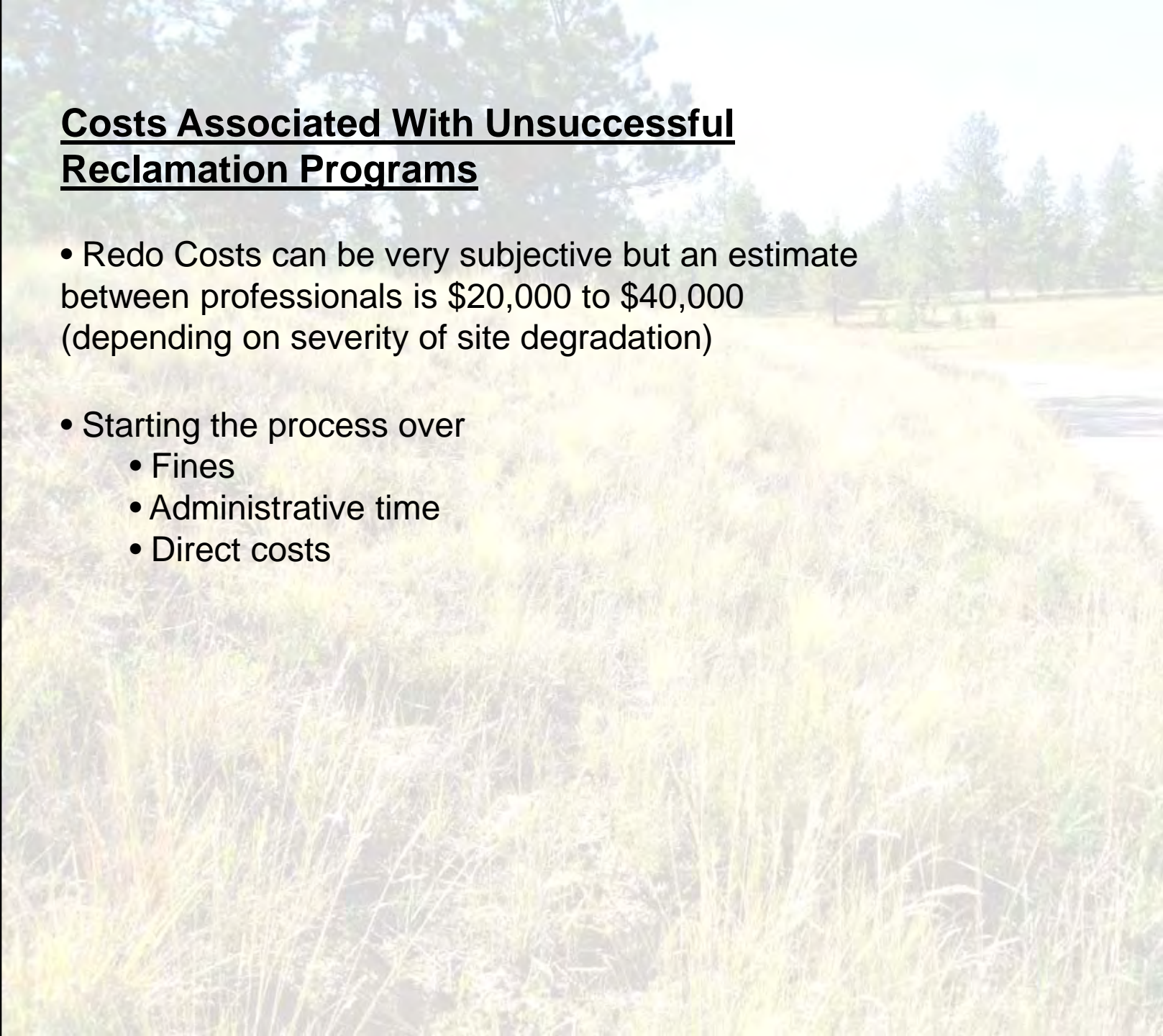
- Redo Costs can be very subjective but an estimate between professionals is \$20,000 to \$40,000 (depending on severity of site degradation)

DISCUSSION

- Starting the process over
 - Fines
 - Administrative time
 - Direct costs

CONCLUSION

SITE PHOTOS



INTRODUCTION

CASE STUDIES

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SITE PHOTOS

Table 3 - Costs Associated with Reclamation Failures

	EnCana - Piceance Basin		Pioneer - Raton Basin	
	<u>(2.1:1 to 3:1)</u>	<u>(1:1 to 2:1)</u>	<u>(2.1:1 to 3:1)</u>	<u>(1:1 to 2:1)</u>
<u>Redo Treatments</u>	<u>Cost per Acre</u>	<u>Cost per Acre</u>	<u>Cost per Acre</u>	<u>Cost per Acre</u>
Sediment Clean Up	\$500 to \$1000	\$500 to \$5,000	\$500 to \$1,000	\$1,000 to \$5,000
Fill Placement	\$500 to \$1000	\$500 to \$5,000	\$500 to \$1,000	\$1,000 to \$5,000
Regrading	\$11,100 to \$13,100	\$10,750 to \$13,750	\$5,000 to \$10,000	\$8,000 to \$15,000
Reseeding and Mulching	Drill Seeding & Crimped Straw \$2,620	Broadcast Seeding & Flexterra Hydromulch \$8,017	Drill Seed, Straw Mulch w/Tackifier \$2,000	Hydroseed, Flexterra Hydromulch \$8,000
Fix BMP's and Add More	\$5,000	\$5,000 to \$10,000	\$5,000	\$10,000
1 Year Extended Weed Control	\$350	\$450	\$250	\$400
Total Costs	\$20,070 to \$23,070	\$25,217 to \$42,217	\$13,250 to \$19,250	\$28,400 to \$43,400

INTRODUCTION

Indirect Cost Estimates Resulting From Unsuccessful Reclamation

CASE STUDIES

- Fines can range from \$0.10 - \$15.00 per acre depending on site conditions and other relevant factors

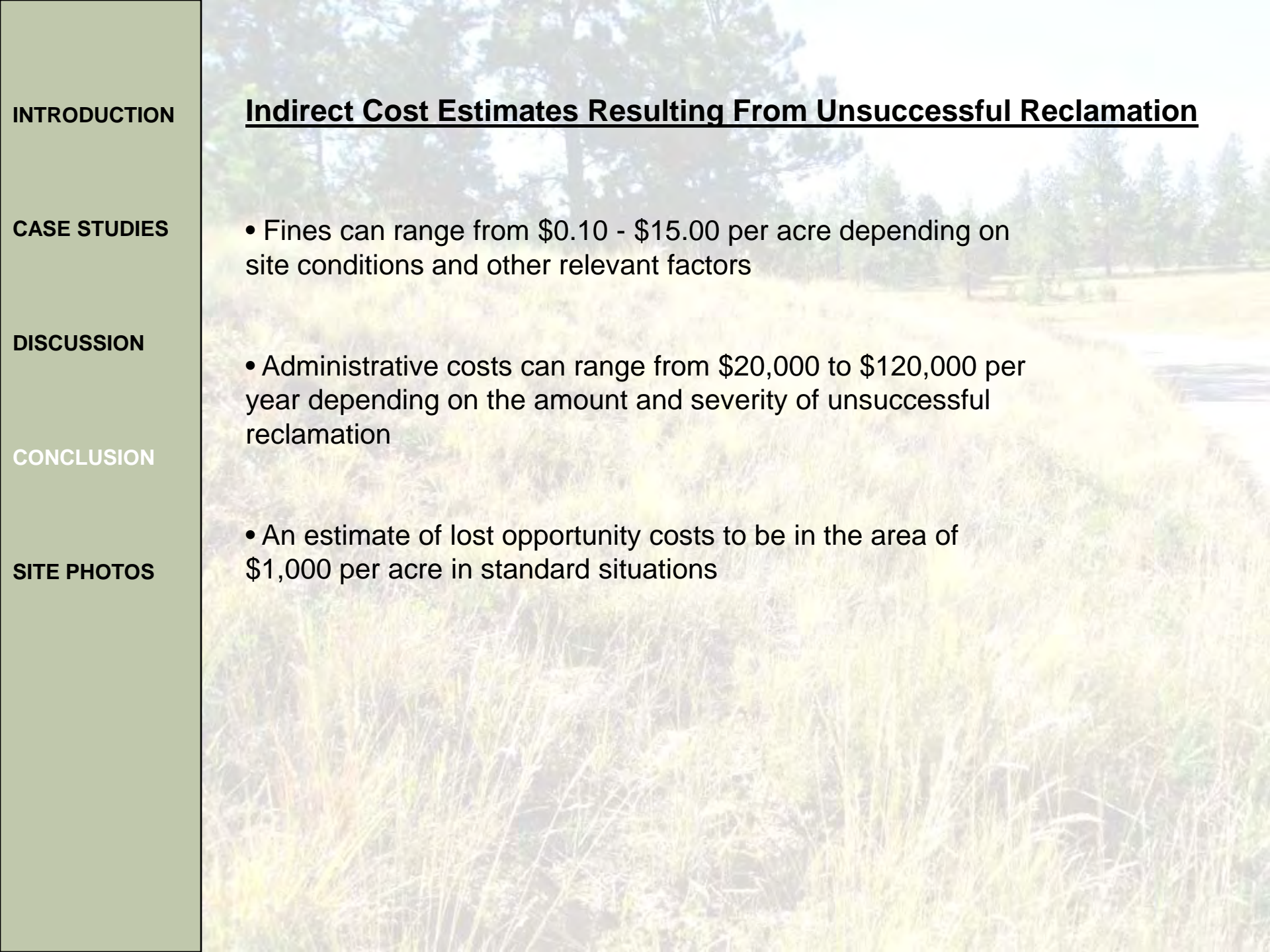
DISCUSSION

- Administrative costs can range from \$20,000 to \$120,000 per year depending on the amount and severity of unsuccessful reclamation

CONCLUSION

- An estimate of lost opportunity costs to be in the area of \$1,000 per acre in standard situations

SITE PHOTOS



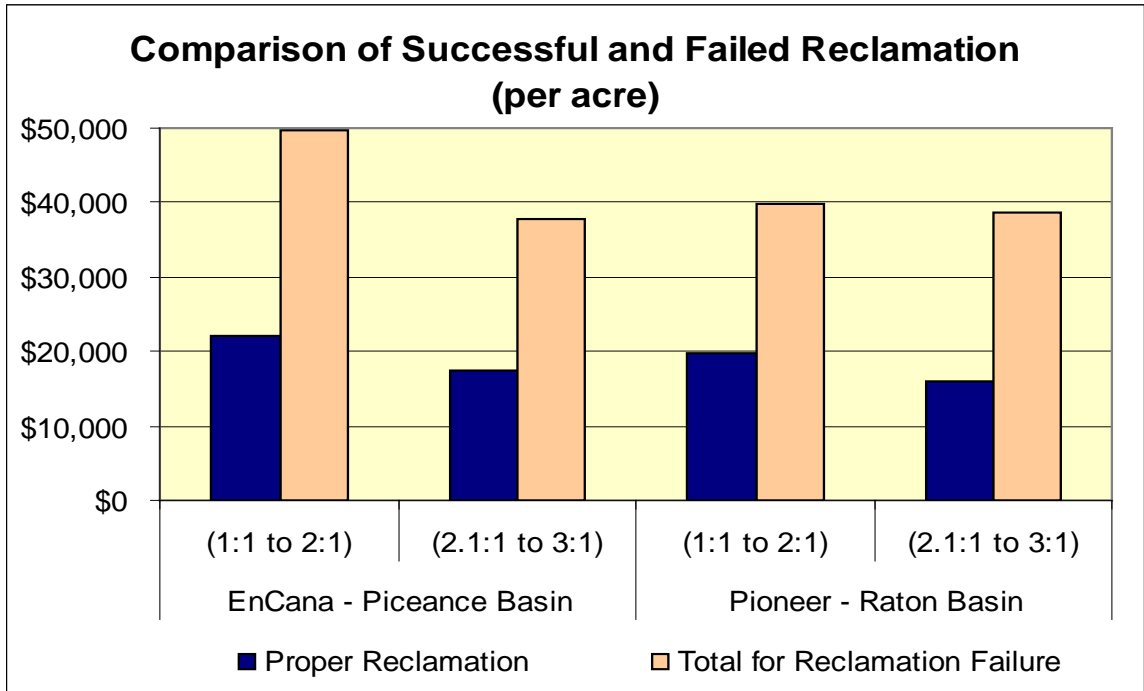
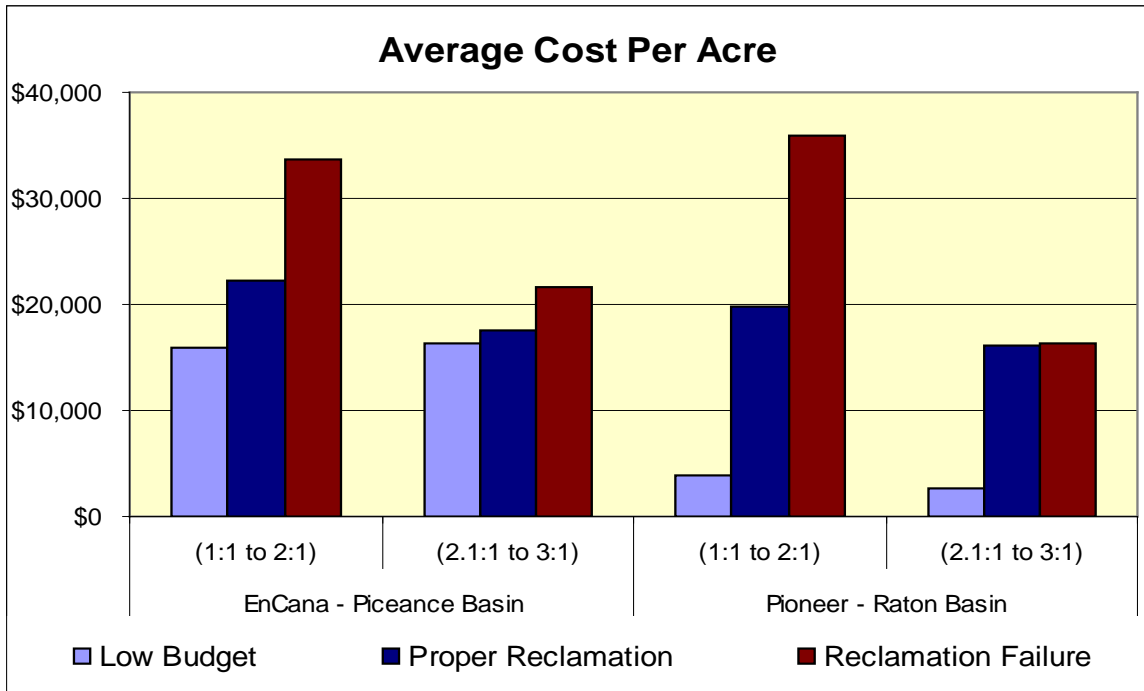
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INTRODUCTION

CONCLUSIONS

CASE STUDIES

- Significant proof that there are economic benefits to proper initial reclamation

DISCUSSION

- Minimal input reclamation programs result in significantly higher failure rates

CONCLUSION

- Reclamation failures can result in a 50% cost increase over initiating proper initial reclamation techniques

SITE PHOTOS

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CONCLUSIONS

CASE STUDIES

Include the accounting department!

DISCUSSION

- Environmental staff has an obligation with company to have a system in place that can track costing and that presents the importance of having adequate budgets for initial reclamation

CONCLUSION

- Environmental staff should consult with accounting staff to find out availability of job costing software and systems. If a software program or system isn't established an Excel spreadsheet or QuickBooks program can suffice

SITE PHOTOS

- Set up effective job costing, coding and report system to account for:
 - Administrative time
 - Consultant time
 - Field repairs

O'NEILL RANCH – PIONEER

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JUNE 2005



SEPTEMBER 2008

O'NEILL RANCH – PIONEER

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JUNE 2005



SEPTEMBER 2008

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JUNE 2005



SEPTEMBER 2008

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BMP Blanket Install



FGM Application

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SITE PHOTOS



Seed + Straw + Slash



ROW – Shrubs + Seed + Slash

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SITE PHOTOS



Trapped Sediment



Sediment Pond

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Before



After

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