Uinta Basin Oil Pipeline Study

Final Report

September 2017

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1 Study Objectives

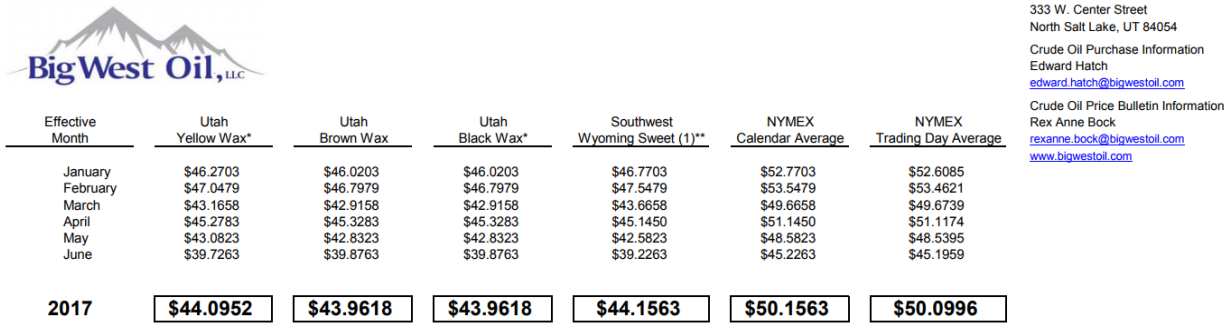
- Provide a fully informed estimate of the market potential for waxy crude outside the Salt Lake City (SLC) refinery complex.
- Provide stakeholders with a full understanding of the implications of historical and future waxy crude discounts on the tax and royalty streams to Federal, State, County, Tribal, and other recipients.
- Estimate the financial and social cost of crude oil transportation alternatives from Uinta Basin to Salt Lake City refineries.

2 Waxy Crude Pricing Analysis

2.1 Pricing Bulletins

- Prices published in Big West and Chevron crude oil pricing bulletins are for merchantable crude oil delivered to refinery gate which represents offer to purchase.
- Merchantable crude oil is oil free of contamination or any added chemicals.
- Truck transportation costs borne by the producer.
- Prices are for oil at 40 degrees API with deductions of $0.015 for each 0.1 degree below 40. A similar deduction is in place if oil exceeds 45 API.
- Not all the Uinta Basin crude oil that moves into the SLC market is priced at the values published in refiner pricing bulletins - bulletins are not entirely representative of Uinta waxy crude oil market value.

Figure 1: Example of a Salt Lake City Refiner Pricing Bulletin



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Effective Month	Utah Yellow Wax*	Utah Brown Wax	Utah Black Wax*	Southwest Wyoming Sweet (1)**	NYMEX Calendar Average	NYMEX Trading Day Average
January	$46.2703	$46.0203	$46.0203	$46.7703	$52.7703	$52.6085
February	$47.0479	$46.7979	$46.7979	$47.5479	$53.5479	$53.4621
March	$43.1658	$42.9158	$42.9158	$43.6658	$49.6658	$49.6739
April	$45.2783	$45.3283	$45.3283	$45.1450	$51.1450	$51.1174
May	$43.0823	$42.8323	$42.8323	$42.5823	$48.5823	$48.5395
June	$39.7263	$39.8763	$39.8763	$39.2263	$45.2263	$45.1959
2017	**$44.0952**	**$43.9618**	**$43.9618**	**$44.1563**	**$50.1563**	**$50.0996**

2.2 Crude Oil Quality Discount Background

- Most world crude oils are priced in relationship to a marker crude such as Dubai, North Sea Brent, or in the case of Uinta waxy crudes, West Texas Intermediate (WTI).
- The differential between any given crude oil and its marker may be narrow or wide, but typically differentials widen when the general level of oil prices rises. Also relevant are changes in refined petroleum product prices in the refiner's local market.
- Crude oil differentials are driven by differences in both quality and location of the crude's production source.

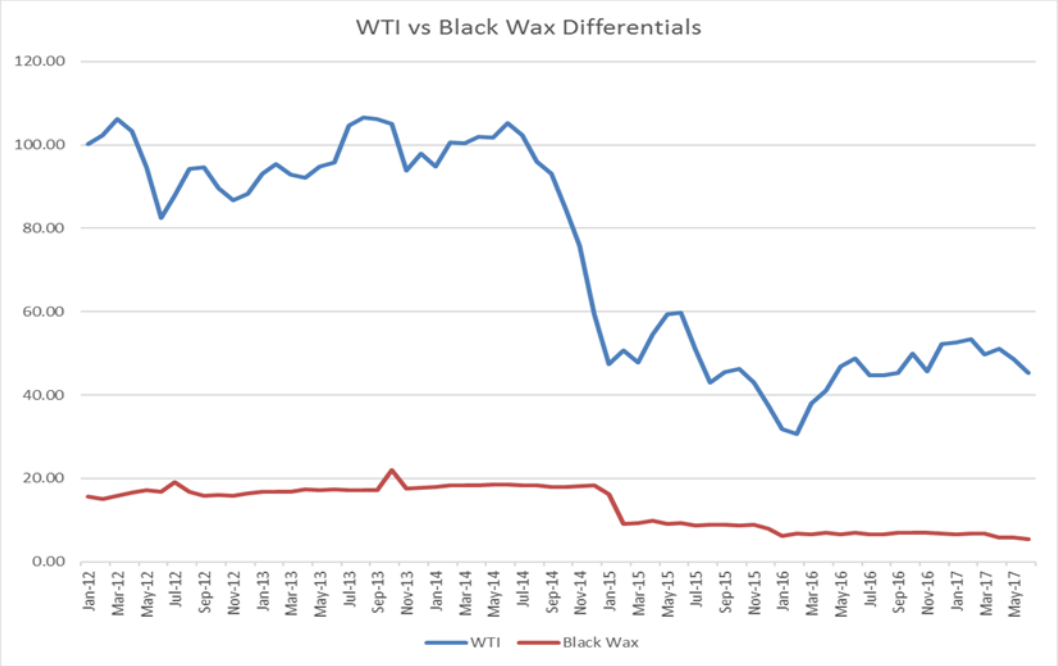
- API, sulphur content, and acid content are three significant quality factors influencing a crude's price differential.
- In order to process a particular crude oil feedstock into high value refined petroleum products, sophisticated, or higher complexity, processing equipment may be required in order to extract that crude's full potential.
- Refiners invest in sophisticated or high complexity refining kit when they feel the feedstock they are planning to run will price in the future at a differential level that justifies capital investment. Sometimes it's only after many years of the right differentials that a refiner will approve new capital spend.
- Refiners optimize monthly crude runs by running a linear programming (LP) model, basing their analysis on variable operating costs, available slate of crude oils and their market prices, and the refinery's potential refined product output slate along with anticipated pricing for those products. The LP model reveals the optimal feedstocks and the resultant optimal refined petroleum product output slate.
- Armed with this knowledge, the refinery crude buyer enters the market and acquires desired feedstocks at the lowest possible price knowing from the LP the maximum price he can afford to pay. The buyer will only pay what he has to in order to obtain the desired feedstock barrels.
- Conditioning this enthusiasm to pay as little as possible however, is the recognition that once in possession of a higher complexity refinery kit, the refiner does not wish to have their investment in expensive new processing equipment idled for lack of the desired feedstock to run through it.
- When a crude oil is pipeline connected, or on tidewater, that crude's location is typically a lesser factor influencing the accorded differential.

2.3 Uinta Basin Crude Oil Quality Discount

- Uinta Basin waxy crudes measure well relative to WTI on the above three quality factors – API, sulphur content, and acid content. However, other non-typical quality factors come into play which makes it more difficult to assess the reasonableness of a refiner's offer to purchase Uinta Basin waxy crude.
- Due to difficult Uinta transportation logistics, the location portion of the differential is nonstandard.
- Uinta Basin waxy crude oils may be processed into high value refined products, but the refineries that run it need relatively sophisticated (higher complexity) processing equipment in order to extract that potential.
- The historical differentials, or quality discounts, for Uinta yellow and black wax crudes published by SLC refiners are remarkably static, showing little if any correlation to changes in WTI prices, save for when WTI prices went from $100/bbl to less than $50/bbl over the course of the second half of 2014.
- Aside from a large adjustment in February 2015, SLC refiners have taken an almost "set it and forget it" approach towards Uinta price bulletin crude oil pricing

- This was especially problematic for producers who sold at refiner pricing bulletin prices in late 2014. WTI prices had dropped by 50%, but Uinta pricing differentials remained stubbornly high, even widening slightly in late 2014.

Figure 2: Uinta Basin Historical Crude Oil Quality Discounts



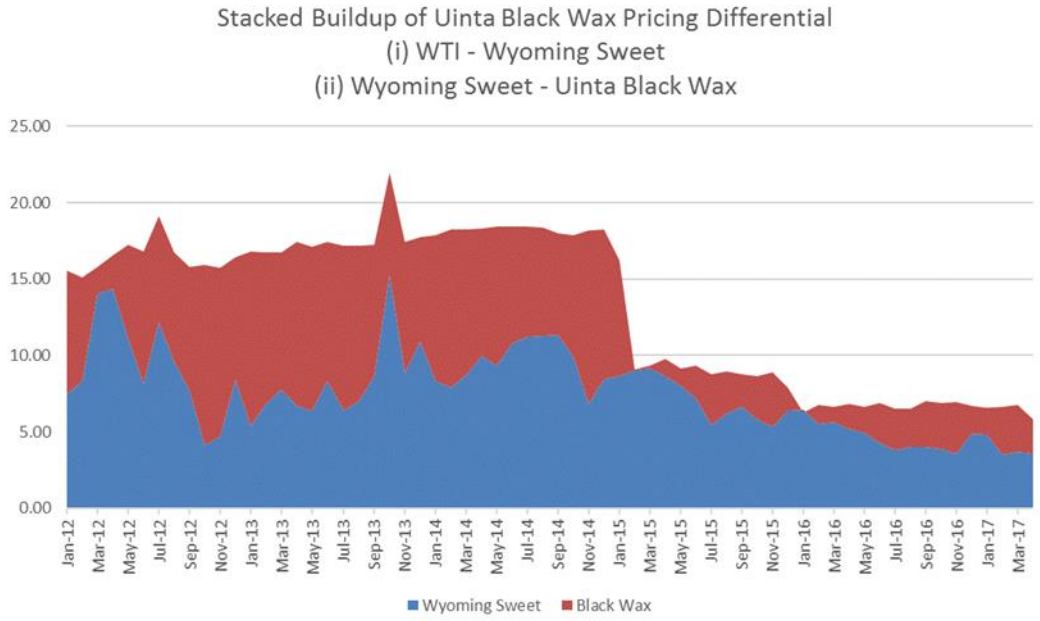
Source: Big West price bulletins. Note, no API price adjustment shown. At 32 API, this would widen the above Black Wax differentials by another $1.20/bbl

- It is because of this apparent non-responsive pricing embodied in the SLC refinery price bulletins that Uinta waxy crude oil producers sought to:
    - Sell their crude oil to SLC refiners at monthly negotiated prices instead, and;
    - Look to alternate markets to sell their crude oil. Uinta Basin producers would benefit from having their crude's value tested in other markets – in a meaningful way.
- As SLC supply agreements expire, the number of transactions done at monthly negotiated prices is expected to rise. The act of negotiating each month provides the producer some comfort that the price they receive is more market responsive.
- Thus, while refiner pricing bulletins are a bona fide offer to purchase at said price, those prices cannot purport to represent the pricing of all, or even the majority of, the Uinta Basin crude oil sold to SLC refiners.
- Anecdotal evidence suggests that monthly negotiated prices range from $1 to $4 per barrel higher than published refiner pricing bulletin prices.

2.4 Comparison of Uinta Basin and Wyoming Sweet Price Discounts

- An alternate approach to examination of the Uinta Basin quality discount is to contrast the Uinta Basin pricing with a nearby crude oil that is close to WTI in quality.
- Wyoming Sweet crude oil (37 API & 0.3% sulphur) is similar to WTI. Since WTI has an API of 40 API, the Wyoming Sweet quality discount should be $0.50/bbl, at most.
- The Energy Information Administration (EIA) publishes actual market transactions for Wyoming Sweet. The calculated WTI less Wyoming sweet differentials (blue area in Figure 3) are essentially a Wyoming versus Cushing location differential.
- Accepting that Wyoming and Utah location differentials vis-a-vis WTI are similar, the graph indicates that during the high price era of 2012-2014, half of the WTI less Uinta Black Wax pricing differential could be explained by a location discount and half because of quality considerations.

Figure 3: Uinta Basin Crude Oil Price Discount Analysis



Sources: EIA for Wyoming Sweet prices; Big West price bulletins for Uinta black wax

- Since the fall in WTI, price differentials for both Wyoming Sweet and Uinta Black Wax have narrowed. Now, nearly three quarters of the WTI less Uinta Black Wax pricing differential can be explained by a location adjustment, the remaining one quarter because of quality.
- Since January 2016, that quality differential between Wyoming Sweet and Uinta Black Wax averaged $2.17/bbl. Since SLC refiner price bulletins also adjust prices down for API less than 40, it is appropriate to subtract $1.20/bbl (40 API minus 32 API times $0.15).
- Therefore, excluding location discounting, the best approximation of the current Uinta Basin Black Wax quality discount is $3.37/bbl = $2.17 + $1.20.

- Either way, the significant discounting of Uinta Black Wax crude oil prices because of location and quality merits the testing of its value in alternate markets.

2.5 Refiner Perspectives

- The following refining backgrounder on desirability of Uinta Basin black waxy crude oil, explains advantages and potential disadvantages.

Uinta Crude Oil Advantages

- Less low octane naphtha and a higher proportion of good quality gas oil content in Uinta Basin waxy crude oil versus other sweet grades.
- Uinta waxy is well suited to hydroprocessing, particularly hydrocracking. When hydrocracked, a refiner will see a roughly 25% volume increase when cracking Uinta crude oil.
- No deleterious nitrogen, metals, acids, or sulphurs.
- Cetane index of diesel fraction is 68.5, well above the minimum requirement of 40.0 to make ultra-low sulphur diesel.
- Very good for production of base oil for manufacture of lubricants.
- Residuum is suitable for anode grade coke due to low metals content.
- 64 refineries in the continental U.S. have the capability to run some Uinta Basin waxy crudes, not considering rail offload capability.
- Including SLC, 18 of those 64 locations are relatively close to the proposed Price River crude rail load terminal – less than 1,000 mile rail trip.
- Three of those plants are large scale California based refineries.
- Belying their small scale, SLC refiners are relatively complex facilities well-suited to process waxy crude. This comes from these refiners making significant capital investment to upgrade their process infrastructure.

Uinta Crude Oil Disadvantages

- Uinta waxy crudes are non-fungible, meaning there are no ready substitutes. This is because of Uinta crude's unique storage and transportation logistics requirements. In contrast, many U.S. crude oil streams are fungible, meaning that oil of different grades or points of origin are largely interchangeable.
- Resulting from small stream size, the Uinta waxy crude oils are also a relatively illiquid crude grade making price discovery difficult.
- In an effort to recoup their investments, SLC refiners exploit these above attributes and pay producers only what they need to in order to prevent Uinta Basin crudes from leaving the state.
- 15 out of the 18 close proximity refineries capable of running some Uinta Basin waxy crudes are disproportionately smaller than the 46 more distant refining locations.
- Half of the close proximity refineries are in California, a region especially hostile to receipt of crude oil by rail:
    - Tesoro's Martinez plant is no longer to receive crude by rail after Kinder Morgan mothballed their Richmond rail offload terminal.
    - Phillips 66 and Valero's San Francisco based refineries have both been denied permits to construct crude by rail offload terminals.

- High pour point owing to high wax content – 46 wt % on whole crude basis.
  - Eagle Ford's light tight oil wax content at 15 wt % is known to cause some refiners processing issues.
  - Other crudes comparable in API such as Louisiana Light Sweet are ~5%.
- Storage tanks need to be heated and insulated.
- Trucking requires short haul in order to avoid set up of the crude.
- Challenging crude rail logistics and handling.
  - Requires use of coil and insulated railcars
  - Like heavy crude oil, steam required at destination in. order to offload railcars carrying Uinta waxy crude.
  - Unlike with heavy crude oil, all rail rack gathering and transfer lines must also be heat traced in order to handle Uinta waxy crude.
  - It is not possible to offload Uinta Basin waxy oil and other crude oils at the same time. When the Uinta Basin waxy crude oil comes in contact with other crudes it has the potential to precipitate asphaltenes.
- Anecdotal evidence suggests a delivery commitment as high as one unit train a day may be required in order to secure a new Uinta crude by rail destination.
- Barging requires use of heated asphalt type vessels.
- Uinta Basin diesel fraction has issues meeting cloud point (crystal formation at low temperature) and pour point specifications.
- Paraffin content in naphtha cut (74%) is higher than other crude oils of similar API such as Louisiana Light Sweet or WTI (50-60%).
- Need catalytic reforming capability to reduce the high paraffin content in the naphtha and increase the octane number for the gasoline product.
- When Uinta waxy crudes are hydrocracked, additional hydrogenation is often needed to convert waxy normal paraffins to more desirable isoparaffin structures needed to meet octane specifications and satisfy gasoline environmental requirements.
- Though Uinta crude is well suited for lubricant production the total lubricants market in the US is small – out of the over 16 million bpd of U.S. refinery crude runs, less than 1% of that total refinery output is production of lubricant.

3 Alternative Markets Analysis

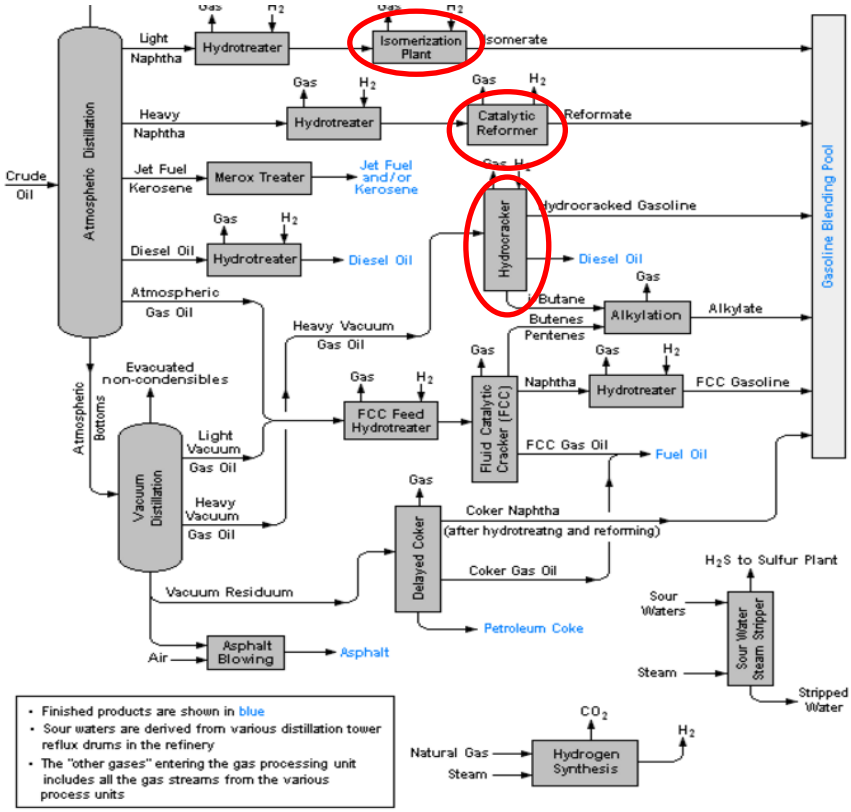
- The following documents alternate market refinery screening criteria and provides rationale for the selection of prospective alternate waxy crude oil markets.

3.1 Screening Criteria

Refinery Complexity

- Refinery complexity is a key criteria.
- Complexity is determined by the presence of one or more of the following pieces of refining hardware:
  - Catalytic reformer – high pressure – used to make refined petroleum products.
  - Fuels solvent deasphalter – used to make extracted base oil.
  - Hydrocracker – distillate, gas oil and/or residual – used to make converted base oil.
  - Lubricants production – using base oil as a feedstock.

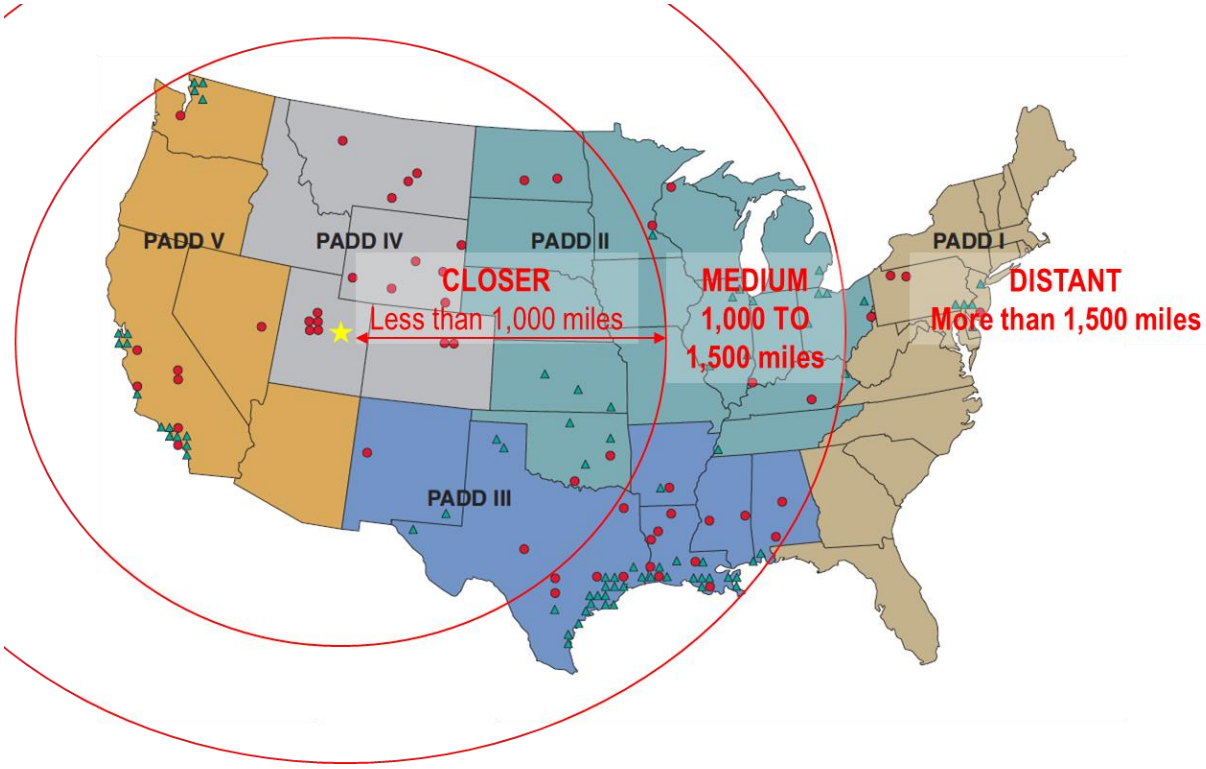
Figure 4: Refinery Hardware Important To Processing of Uinta Crude



3.1.1 Rail Distance

- Rail distance from Uinta Basin is another criteria.
- Rail distance is defined by distance from the site of the proposed Uinta crude by rail load terminal to the target refining region.
  - Closer – less than 1,000 miles.
  - Medium – between 1,000 and 1,500 miles.
  - Distant – more than 1,500 miles.
- Note: Conventional wisdom is that rail is economic only when the haul distance exceeds 400 miles.

Figure 5: Rail Distance from Uinta Basin



Source: American Fuel & Petrochemical Manufacturers website.
Yellow Star = Location of proposed Uinta crude by rail load terminal
Green Triangles = Refineries with distillation capacity greater than 75,000 barrels per day
Red Circles = Refineries that are less than 75,000 barrels per day

Refinery Scale & Rail Offload Capability

- Refinery scale, as measured by atmospheric distillation capacity is a third criteria
    - Small – less than 125,000 barrels per day.
      Examples: SLC refineries; Phillips 66 Santa Rosa, California; Calumet Shreveport, Louisiana.
    - Medium – between 125,000 and 250,000 barrels per day.
      Examples: BP Cherry Point, Washington; PBF Torrance, California; Valero St Charles, Louisiana
    - Large – more than 250,000 barrels per day.
      Examples: ExxonMobil Baton Rouge, Louisiana, Shell Deer Park, Texas; Valero Port Arthur, Texas.
- Also important is whether the refinery has crude by rail offload capability and whether or not the rail rack has the required steam capabilities.

3.2 Refiner Interviews

Interview Process

- Refiner interviews were conducted either in person, by telephone and/or via e-mail
- Purpose of the interviews was to ultimately identify:
    - Alternate market locations for Uinta waxy crude oil.
    - Rank those alternate market locations by 'Higher Priority' and 'Lower Priority'.
    - Identify refinery locations and/or regions where there is significant local opposition to receipt of crude oil by rail.
    - Identify refinery locations where Uinta waxy crude oil is NOT a good fit.
- Refiner interview questions included the following:
    - How waxy crude oils are captured in refiner linear program runs.
    - Views on prospective Uinta waxy crude oil pricing differentials vis-a-vis WTI.
    - Potential demand for Uinta crude oil.
    - Potential opportunities to blend Uinta Basin waxy crude oil with other crude oils in order to obtain a price uplift.
    - Other commercial considerations

Findings Summary

- There are nine top rated refinery targets outside the SLC refining region.
- Seven of the nine are in the USGC:

Louisiana	Calumet Shreveport ExxonMobil Baton Rouge Marathon Garyville Valero St Charles
Texas	ExxonMobil Baytown Shell Deer Park Valero Port Arthur

- The other two top rated refinery targets are both BP refineries.

Indiana	BP Whiting
Washington	BP Ferndale

- Six of the nine top rated refineries have rail offload. The three that do not are all interested in adding rail offload capability.
- There are no top rated California refineries owing to significant local opposition to crude by rail – of any kind.

In all, there are 64 refining locations with the capability of processing some Uinta waxy crude oil in meaningful quantities. See Table 8 and Table 9 in Appendix 1 for a complete list.

Refiners Interviewed

- 12 refining companies outside of the SLC area were contacted. The contacted refineries represent an aggregate distillation capacity equal to 80% of the total distillation capacity of all 64 refineries with Uinta crude processing capability.
- 10 of the 12 refiners were interviewed – BP, Calumet, ExxonMobil, Flint Hills, Marathon, PBF, Phillips 66, Shell, Sinclair, Valero.
- Uinta Basin oils are understood as a crude grade with many refiners citing their experiences in running Uinta waxy crude.
- Two of the 12 refiners did not respond – CHS and Citgo.
- One SLC refiner was contacted, Tesoro, who did not respond.

Refiner Linear Program (LP) and Pricing Perspectives

- Uinta waxy crude oil is desirable because:
  - Uinta waxy is a light crude oil.
  - Balanced distribution across the boiling range cut points.
  - No sulphur, acid, nitrogen or metals.
- However, Uinta Basin waxy crudes chew up a disproportionate amount of a refinery's catalytic reformer and hydrocracker capacities in addition to any hydrogenation capability.
- Diesel make has cloud point and pour point issues.
- The above considerations more than offset Uinta's positives.
- Uinta waxy crudes are expected to price in line with heavies such as Mayan or Western Canadian Select or at a slight discount to these grades.
- Refiners cited that running Uinta waxy would mean backing out a heavy barrel.

Potential Demand for Uinta Crude Oil

- Some refiners outside of the local SLC market area expressed skepticism about prospects for consistent supply of Uinta waxy crude deliveries by rail.
- Doubts expressed about economic viability of the proposed Myton pipeline and Price River Terminal rail load development – seen as hypothetical only.
- Belief that future Uinta Basin waxy crude oil output must outstrip SLC local refiner capabilities by a sizeable margin before it makes sense to talk about supply of Uinta waxy crude by rail.
- Most refiners felt that at today's differentials there are no economics to support rail to destinations outside of SLC.

Uinta Blending Potential

- In general, refiners have no interest in having a supplier blend crude oil on their behalf and that belief carries forward with respect to Uinta waxy crude oil.
- RBN Energy cites that using lighter hydrocarbons as a diluent, the same way that Canadian heavy crude shippers do with bitumen to make pipeline specification dilbit, does not work with waxy crudes. Chevron has pipeline transported some Uinta waxy crude oil but only when the Uinta proportion is very low – less than 5%.
- As stated previously, refiners are generally not supportive of blending activities, especially if they find that the crude oil that they purchased causes fouling in their crude preheat train and

other heat exchangers. Other paraffin related issues cited by refiners are asphaltene instability, sludge formation in the desalter, and fouling in processing equipment.

Other Commercial Considerations

- Non-fungible, illiquid grade – refiners will discount Uinta waxy because it is a more difficult feedstock to trade out when refinery crude runs do not go as planned.
- Need rail offload with steam at the refinery gate in order to take Uinta waxy crude.
  - There are only eight refineries that meet this criteria and have capability to run Uinta waxy crude.
  - In order for a refiner to construct such facilities, a unit train per day supply commitment would be required; approximately 50,000 barrels/day.
  - However, if transport capacity for Canadian heavies remains constrained, refiners may add more rail offload capacity with steam.
  - Due to asphaltene precipitation, rail offload capability is effectively sterilized for use by any other crude type while offloading Uinta Basin waxy crudes.
- Several California refiners would like to run Uinta waxy crude but there is significant local opposition to rail/trucks/barges.
- Need for a term agreement cited by many of the refiners.

3.3 Crude Trader Interviews

- Crude oil trading companies make a business of turning low value crude types into higher value crudes by blending. Cushing, OK is a major center for this type of activity.
- In order to blend at Cushing, heated and insulated tankage is needed since otherwise paraffins will form sludge, solids, and waxes in crude storage tanks and lines. Without heat, terminals handling high-wax tight oil can find as much as 5.0 feet of sludge buildup in a storage tank.
- Evidence provided by one trading company is that Uinta blend proportions of 20-25% can be routinely achieved; the resultant product achieving WTI value. There may also be potential to blend into an intermediate product like gas oil, rather than into another crude oil stream.
- A major trading company railed 6,000 barrels per day of Uinta crude oil into Cushing in 2014, 7,700 barrels per day in 2015, achieving WTI pricing for their barrels.
- Producers did not engage in this activity directly, instead selling their crude oil to the trading company in the field.
- The trading company believes that more volume could be blended in this way without issue.

3.4 Break Even WTI Prices

USGC Sale – Refiner as Customer Scenario

- When selling direct to USGC refiners, $81.10 per barrel is an estimated “break-even” WTI price by which Uinta Basin crude may be profitably shipped to those alternate markets.
- This approach reflects most typical producer behavior and their more conservative approach to crude oil commercial activities.
- Producers are generally reluctant to pursue Cushing, OK blending, leaving those activities (and their associated arbitrage risks and rewards) to crude oil trading companies.

Table 1: WTI "Break-Even" Price – USGC Sale – Refiner as Customer Scenario

WTI "BREAK-EVEN" PRICE - USGC SCENARIO
UINTA BLACK WAXY CRUDE OIL
All figures $/barrel

					Break-Even	
Market Destination	**SLC**	**USGC**	**SLC**	**USGC**	**SLC**	**USGC**
Pricing:						
WTI Case	**50.00**	**50.00**	**100.00**	**100.00**	**81.10**	**81.10**
Differential	7.90	5.75	18.44	7.42	14.46	6.79
Price at Refinery	42.10	44.25	81.56	92.58	66.64	74.31
Transport:						
Rail offload	0.50	0.67	0.50	0.67	0.50	0.67
Rail fee	1.15	8.50	1.15	8.50	1.15	8.50
Railcar lease	0.10	0.40	0.10	0.40	0.10	0.40
Rail load - Price River	0.50	0.30	0.50	0.30	0.50	0.30
Pipeline fee	2.10	2.10	2.10	2.10	2.10	2.10
Myton terminal fee	0.25	0.30	0.25	0.30	0.25	0.30
In basin trucking	1.50	1.50	1.50	1.50	1.50	1.50
Sub-total	6.10	13.77	6.10	13.77	6.10	13.77
Field Price	**36.00**	**30.48**	**75.46**	**78.81**	**60.54**	**60.54**

USGC Assumptions

- Differential for $50 WTI & SLC sale - 2016 average Big West differential + 32 API quality adjustment.
- Heavy value for Uinta crudes delivered to USGC - Mexican Maya equivalent.
- Differential for $50 WTI and USGC sale - WTI Cushing - Maya USGC = $5.75.
- Differential for $100 WTI & SLC sale - Average Big West differential 2012 through mid-2014 + 32 API adjustment.
- Differential for $100 & USGC sale
  - Used Maya USGC prices 2011 through 2014
  - Cannot use historical WTI prices from this time period because of transport congestion which no longer exists.
  - LLS did not suffer from congestion – used to create no congestion WTI
  - WTI Cushing - Maya USGC = $7.42.
- Break-even WTI differential straight line data point between $50 and $100 WTI cases.
- Bakken crude by rail all in cost from field to USGC used as reference. ~$10.00 – Fitch.
- Bakken to USGC, or Price River to USGC, same distance ~1,500 miles.
- RBN Energy estimates $12 per barrel rail only fee from Hardisty, Alberta, Canada to USGC - 2,300 miles.
- Bakken to USGC at two thirds the distance equates to ~$8.50 rail fee.
- Estimated disaggregated cost ~$10.00 = load $0.50, railcar lease $0.50, unload $0.50, rail fee $8.50.
- Rail offload at SLC per Azure of $0.50.

- Rail offload at USGC - rail offload fee estimates vary widely. RBN Energy estimates $1.50 versus a Bakken estimated offload (no steam) = $0.50. Need steam, therefore = $0.67.
- Rail fee from Price River to SLC = $1.15 per Azure. 125 miles. Much debate around whether this fee is too high / too low.
- Rail fee from Price to USGC - based on fee backed out of Bakken rail cost $8.50.
- Railcar lease for SLC deliveries $0.10 per Azure – estimate one turn every 1-2 days.
- Railcar lease for USGC deliveries will be higher because not as many turns per month = $0.40 – estimate one turn every 10-12 days.
- Fees for Price Terminal rail load, pipeline, Myton terminal, and in-basin trucking per Azure.

Cushing Sale – Trader as Blender Scenario

- When blending with other light crude oil in Cushing and selling Uinta waxy as WTI a $40.75 per barrel “break-even” WTI price is the result.
- That is to say, there is currently an advantage to the sale and blending of Uinta waxy crude oil into the Cushing market.
- It is difficult to predict how much Uinta waxy could be blended in this way, nor for how long. The trader as blender pricing scenario in this sense is not without risk.

Table 2: WTI "Break-Even" Price – Cushing Sale – Trader as Blender Scenario

WTI "BREAK-EVEN" PRICE - CUSHING WTI BLENDING SCENARIO
UINTA BLACK WAXY CRUDE OIL
All figures $/barrel

					Break-Even	
Market Destination	**SLC**	**Cushing**	**SLC**	**Cushing**	**SLC**	**Cushing**
Pricing:						
WTI Case	**50.00**	**50.00**	**100.00**	**100.00**	**40.75**	**40.75**
Differential	7.90	0.00	18.44	0.00	5.95	0.00
Blending Fee		0.58		0.58		0.58
Price at Refinery	42.10	49.42	81.56	99.42	34.80	40.17
Transport:						
Rail offload	0.50	0.67	0.50	0.67	0.50	0.67
Rail fee	1.15	6.25	1.15	6.25	1.15	6.25
Railcar lease	0.10	0.40	0.10	0.40	0.10	0.40
Rail load - Price River	0.50	0.30	0.50	0.30	0.50	0.30
Pipeline fee	2.10	2.10	2.10	2.10	2.10	2.10
Myton terminal fee	0.25	0.25	0.25	0.25	0.25	0.25
In basin trucking	1.50	1.50	1.50	1.50	1.50	1.50
Sub-total	6.10	11.47	6.10	11.47	6.10	11.47
Field Price	**36.00**	**37.95**	**75.46**	**87.95**	**28.70**	**28.70**

Cushing Assumptions

- No differential for Cushing sale as Uinta crude oil is assumed to receive WTI pricing
- Blending fee was obtained from trading company that railed into Cushing in 2014-2015.

- Price River to Cushing backed out of Bakken light crude oil rail cost as above
- Distance ~1,000 miles. Equates to $5.67 unit train rail fee
- 70 car unit trains instead of 100 due to tunnel restrictions increases rail fee by 10% = $6.25

4 Utah Oil Royalty and Tax Revenue Analysis

- Waxy crudes are, more or less, posted at a fixed discount to WTI to relatively higher production, processing, and transportation costs.
- This results in decreased tax and royalty revenues to various recipients.
- The objective was to provide stakeholders with a full understanding of the implications of historical and future waxy crude discounts on the tax and royalty streams to Federal, State, County, Tribal and other recipients

4.1 Data Sources

- Public sources in the analysis included:
  - Utah State Tax Commission; Annual Revenue Summary.
  - Utah State Legislature; Related Legislation.
  - Utah Department of Natural Resources - Division of Oil, Gas and Mining; Production Data.
  - Utah Department of Workforce Services - Housing and Community Development Division; Legislative Report of the Permanent Community Impact Fund.
  - UDOT Mineral Lease Funds; Mineral Lease Fund Distributions.
  - US Energy Information Administration; Utah Crude Oil First Purchase Price.
  - Big West Oil LLC; Crude Oil Bulletin.

4.2 Key Assumptions

- Certain assumptions were made for each revenue tool in order to guide calculations.
- **Severance Tax**
  - County and Ute Tribe receipts are capped and distributed based on research from best publicly available sources.
  - Taxable value of oil determined based on actual tax receipts as a ratio of potential receipts using the total value of oil produced.
- **Utah Conservation Fee**
  - Fair market value of oil determined based on actual tax receipts as a ratio of potential receipts using the total value of oil produced.
- **Ad-Valorem Property Tax**
  - Change in oil price is assumed to carry through re-assessments of future production values in assigning property values.
  - Fair market value of oil determined based on actual tax receipts as a ratio of potential receipts using the total value of oil produced.
- **Mineral Lease Funds**
  - Community Impact Board (CIB) receipts estimated at a total of 46.5% of state revenues based on FY 2016 CIB revenue data (includes 32.5% of mineral lease royalty money and 70% of bonus).

- **Royalty Payments**
  - Royalty amounts were based on weighted average percentages from various sources: 12.5% Federal (of which 49% disbursed to State), 14% State, 18% Tribal, and 15% Private.

4.3 Fiscal Impact Calculator

- The calculator developed allows a user to view, in monetary terms, the revenue impact arising from changes to pricing and production.
- Tax and royalty rates, as well as revenue allocation inputs can be modified
- A dollar change in the waxy crude discount to WTI results in a +/- $6.2M impact.

Figure 6: Fiscal Impact Calculator Dashboard

Calculator Instructions

All user inputs are marked in blue font
1) Modify custom values under 'Inputs' below
2) Adjust tax rates, royalty rates, and revenue allocation allocation inputs in the 'Revenue Allocation' tab

Inputs

Variables	2015 Actuals	Custom Inputs
Pricing ($/bbl)		
Wtd. Avg. Wax Crude Prices	$38.66	$39.66
Avg. WTI Price	$48.66	$48.66
Discount vs. WTI	$10.00	$9.00
Production (bopd)		
Duchesne County	46,887	46,887
Uintah County	34,937	34,937
Uinta Basin	**81,824**	**81,824**

2014-2015 Discounts were much higher than recent 2016 priced with discounts around $5-7

Key Assumptions

Severance Tax

* County and Ute Tribe receipts are capped and distributed based on research from sources including the "Performance Audit on the Use of Mineral-Related Funds in Uintah Basin" carried out for Utah Legislature in 2008.

* Taxable value of oil determined based on actual tax receipts as a ratio of potential receipts using the total value of oil produced.

Utah Conservation Fee

* Fair market value of oil determined based on actual tax receipts as a ratio of potential receipts using the total value of oil produced.

Ad-Valorem Property Tax

*Change in oil price is assumed to carry through re-assessments of future production values in assigning property values.

* Fair market value of oil determined based on actual tax receipts as a ratio of potential receipts using the total value of oil produced.

Mineral Lease Funds

*CIB receipts estimated at a total of 46.5% of state revenues based on FY 2016 CIB revenue data (includes 32.5% of mineral lease royalty money and 70% of bonus).

Royalty Payments

* Royalty amounts were based on weighted average percentages from various sources: 12.5% Federal (of which 49% disbursed to State), 14% State, 18% Tribal, and 15% Private.

Results - Revenues Attributable to Uinta Basin Crude Oil Production

Revenues by Recipient	Revenues ($M) at 2015 $10.00 Price Discount	Revenues ($M) at a $9.00 Price Discount	Revenue Impact ($M) from a $1.00 Change in Discount
Severance Tax			
Duchesne County	$1.36 M	$1.36 M	+$0.00 M
Uintah County	$1.36 M	$1.36 M	+$0.00 M
Ute Tribe	$1.75 M	$1.75 M	+$0.00 M
State of Utah	$13.90 M	$14.44 M	+$0.54 M
Total	**$18.37 M**	**$18.91 M**	**+$0.54 M**
Utah Conservation Fee			
Utah DOGM	$2.00 M	$2.05 M	+$0.05 M
Total	**$2.00 M**	**$2.05 M**	**+$0.05 M**
Ad-Valorem Property Tax			
Duchesne County	$12.68 M	$13.01 M	+$0.33 M
Uintah County	$14.72 M	$15.10 M	+$0.38 M
Total	**$27.40 M**	**$28.11 M**	**+$0.71 M**
Mineral Lease Funds			
Duchesne County	$3.90 M	$4.00 M	+$0.10 M
Uintah County	$7.51 M	$7.71 M	+$0.19 M
Community Impact Board	$19.64 M	$20.14 M	+$0.51 M
State of Utah and State Agencies	$11.16 M	$11.45 M	+$0.29 M
Total	**$42.21 M**	**$43.31 M**	**+$1.09 M**
Royalty Payments			
Federal Government	$27.09 M	$27.79 M	+$0.70 M
State of Utah	$9.96 M	$10.21 M	+$0.26 M
Ute Tribe	$71.01 M	$72.85 M	+$1.84 M
Private	$39.62 M	$40.65 M	+$1.02 M
Total	**$147.68 M**	**$151.50 M**	**+$3.82 M**

Total Revenues			
Federal Government	$27.09 M	$27.79 M	+$0.70 M
State of Utah	$35.01 M	$36.10 M	+$1.09 M
Duchesne County	$17.94 M	$18.37 M	+$0.43 M
Uintah County	$23.59 M	$24.17 M	+$0.58 M
Ute Tribe	$72.76 M	$74.60 M	+$1.84 M
Utah DOGM	$2.00 M	$2.05 M	+$0.05 M
Community Impact Board	$19.64 M	$20.14 M	+$0.51 M
Private	$39.62 M	$40.65 M	+$1.02 M
Total	**$237.66 M**	**$243.88 M**	**+$6.22 M**

5 Analysis of the Social Cost of Crude Oil Transportation Alternatives

- The objective was to estimate the financial and social cost of crude oil transportation in Utah for each supply chain alternative.
- Alternatives considered include:

1) The current, "***truck-only***" supply chain defined by:
    a. Trucking crude oil an average of 150 miles from the Uinta Basin to SLC refineries.
2) Proposed "***truck-pipe-rail-pipe***" supply chain described as:
    a. Truck crude oil an average of 20 miles from the Uinta Basin to the Myton Pipeline header.
    b. Transload from truck to pipeline.
    c. Pipe 61 miles from the Myton Terminal to the Price River Rail Terminal.
    d. Transload from pipeline to rail.
    e. Transport crude via rail 125 miles from the Price River Rail Terminal to the SLC Rail Terminal/Refinery Pipeline header then transload to pipe.
    f. Pipe an average of 3.2 miles from the SLC Terminal to various SLC refineries.

- The following impact categories were monetized in the public benefit-cost analysis:

    - ***Pavement maintenance cost savings*** from reduced truck movements.
    - ***Improved safety and avoided accident costs*** from diverting trucks to pipeline and rail.
    - ***Reduced truck operating costs*** from reduced truck movements.
    - ***Truck congestion cost savings*** from reduced truck movements.
    - ***Emission cost savings*** from diverting trucks to pipeline and rail/
    - ***Travel time impacts*** from diverting trucks to pipeline and rail.
    - ***Shipper cost impacts*** arising from an increase in transportation cost for the proposed "truck-pipe-rail-pipe" supply chain, and;
    - ***Pipeline land degradation impacts*** due to pipeline implementation.

5.1 Key Assumptions

Table 2: Key Assumptions for Benefit-Cost Analysis

Variable Name	Unit	Source
Avg. Cost of Shipping Crude Oil to SLC by Truck	$5.00/bbl	Producer interviews
Avg. Cost of Shipping Crude Oil to SLC via "Truck-Pipe-Rail-Pipe"	$6.11/bbl	Provided by project proponent and validated through interviews
Avg. Truck Crude Oil Capacity	285 bbl/truck	HDR estimate
Avg. Rail Car Crude Oil Capacity	600 bbl/railcar	HDR estimate assuming 286K coiled, insulated tank cars
Avg. Rail Cars per Train	100 railcars /train	HDR estimate assuming unit crude oil trains of 120 cars and average load of mixed manifest freight trains of 80 cars
Pipeline Capacity	70 mbd	Provided by project proponent
Estimated Pipeline ROW Width	50 ft	HDR assumption

5.2 Results

Detailed Project Impacts

Table 3: Benefit-Cost Analysis Results by Impact Category

NPV Over 40 Years of Operations ($M 2016)	Undiscounted	3%	7%
Pavement Maintenance Costs Savings from Reduced Truck Movements	$340	$178	$89.70
Improved Safety and Avoided Accident Costs from Diverting Trucks to Pipeline and Rail	$753	$379	$183
Reduced Truck Operating Costs from Reduced Truck Movements	$436	$227	$114
Truck Congestion Cost Savings from Reduced Truck Movements	$111	$58.20	$29.40
Emission Cost Savings from Diverting Trucks to Pipeline and Rail	$108	$56.90	$51.60
Travel Time Impacts From Diverting Trucks to Pipeline and Rail	$486	$254	$128
Capital Costs	($250)	($231)	($208)
Total Incremental O&M Costs	($624)	($327)	($166)
Pipeline Land Degradation Impacts	($4.04)	($2.13)	($1.10)
Shipper Cost Impacts	($246)	($214)	($155)
Net Present Value	**$1,109**	**$378**	**$65.70**

- The majority (31%) of all cost savings arise from improved safety and avoided accident costs
- Other key impacts include travel time impacts (22% of total) and reduced truck operating costs (19% of total).

Project Costs

Table 4: Project Capital, Operations, and Maintenance Costs

Total Capital Expenditures (CAPEX) - $M 2016	
Snowboard Pipeline	$107
Myton Facility	$49.80
Price River Terminal (PRT) Facility	$30.70
Salt Lake City (SLC) Terminal Facility	$44.80
Pipeline Header Infrastructure	$18.10
Total CAPEX	**$250**
Annual Operations and Maintenance Expenditures (OPEX) - $M 2016	
Snowboard Pipeline	$1.80
Myton Facility (Including Transloading)	$1.50
PRT Facility (Including Transloading)	$1.08
SLC Rail Terminal/Refinery Pipeline Header (Including Transloading)	$1.62
Railroad	$9.81
Total OPEX	**$15.80**

- The top three CAPEX items are the Snowboard Pipeline (42.8% of total), Myton Facility (19.9% of total), and the SLC Terminal Facility (17.9% of total)
- Similarly, the top OPEX items include Railroad (62.0% of total), Snowboard Pipeline (11.4% of total), and the SLC Rail Terminal/Refinery Pipeline Header (10.2% of total)

Benefit-Cost Analysis

Table 5: Benefit-Cost Analysis Results

Millions of 2016$	**7% Discount Rate**	**3% Discount Rate**
Total Discounted Benefits	$596	$1,152
Total Discounted Costs	$530	$774
Net Present Value	**$65.7**	**$378**
Benefit Cost Ratio	1.12	1.49
Internal Rate of Return (%)	8.16%	
Payback Period (years)	14.7	

- At a 7% discount rate, the project results in a net benefit of $65.7 million from a societal standpoint and informs a Benefit-Cost Ratio (BCR) of 1.12.
- The payback period is approximately 14.7 years, while the Internal Rate of Return (IRR) is estimated at 8.16%.

Pertinent Quantified Project Impacts

- To provide additional insight into project outcomes, quantified (non-monetized) impacts were estimated as provided in Table 3.
- Shipments by rail are associated with lower levels of emissions, apart from SO_2.

Table 6: Pertinent Quantified Impacts over the 40 Year Study Period

Project Life Cycle Impact	
Truck-miles Diverted from Public Roads to Rail	915M miles
Reduced Truck Travel Time	18.3M hours / 2088 days
Avoided CO_2 Emissions	1,346,063 tons
Avoided NO_x Emissions	645 tons
Avoided VOC Emissions	29 tons
Avoided $PM_{2.5}$ Emissions	55 tons
Increase in SO_2 Emissions	48 tons
Fatalities Avoided by Diverting Trucks from Public Roads to Rail	42 fatalities
Injuries Avoided by Diverting Trucks from Public Roads to Rail	1030 injuries

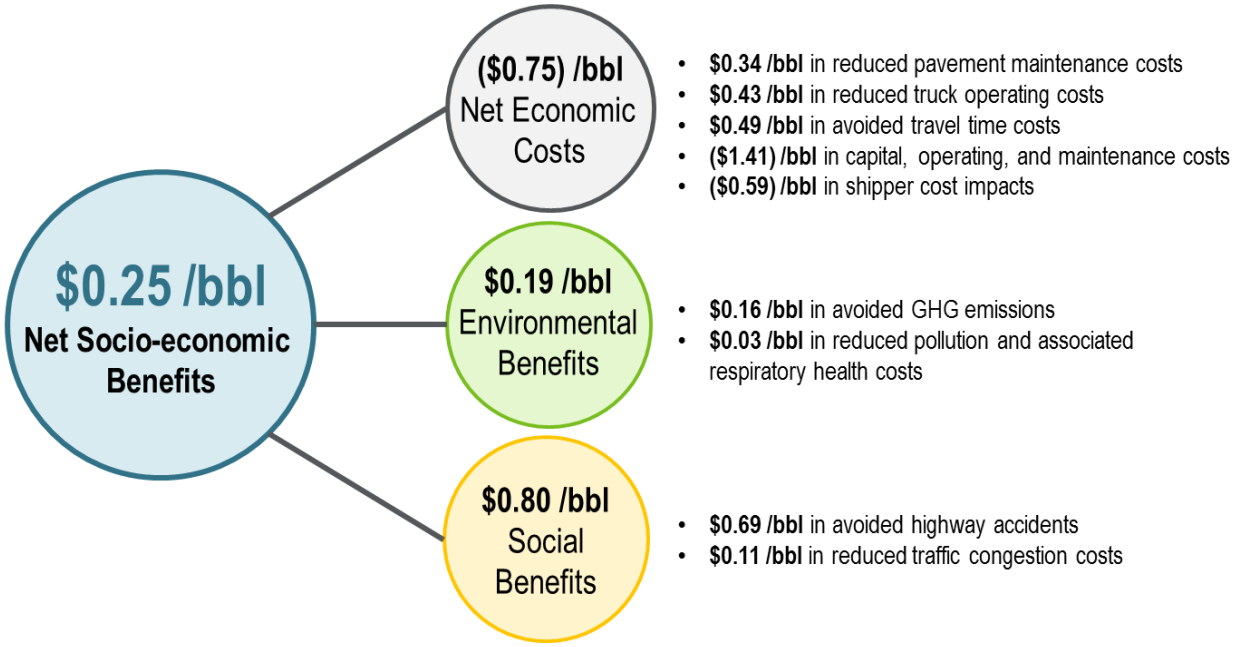
5.3 Levelized Impacts

- Levelized impacts represent project outcomes on a per-barrel-of-oil basis in today's dollars, capturing the full life cycle impacts of the project.

Table 7: Benefit-Cost Analysis Levelized Results per Barrel Transported

Impact - 2016 $/bbl	No-Build	Build	Net Benefits
Capital, O&M Costs	$0.00	$1.41	($1.41)
Pavement Maintenance Costs	$0.39	$0.05	$0.34
Truck Operating Costs	$0.50	$0.07	$0.43
Travel Time Impacts	$0.58	$0.09	$0.49
Shipper Cost Impacts	$5.52	$6.11	($0.59)
Total Economic Impacts	**$6.99**	**$7.73**	**($0.75)**
Greenhouse Gas (GHG) Impacts	$0.29	$0.13	$0.16
Criteria Air Contaminant (CAC)/ Respiratory Health Impacts	$0.08	$0.05	$0.03
Total Environmental Impacts	**$0.37**	**$0.18**	**$0.19**
Safety and Accident Impacts	$0.91	$0.22	$0.69
Traffic Congestion Impacts	$0.13	$0.02	$0.11
Land Degradation Impacts	$0.00	$0.00	$0.00
Total Social Impacts	**$1.04**	**$0.24**	**$0.80**
Total Socio-Economic Levelized Impacts	**$8.40**	**$8.15**	**$0.25**

Figure 7: Levelized Socio-economic Impacts



Appendix 1

Table 8: Refinery Targets

Refiner	Location	State	Atmospheric Distillation	Catalytic Reforming High Pressure	Fuels Solvent Deasphalting	Distillate Hydro-cracking	Gas Oil Hydro-cracking	Residual Hydro-cracking	Total Hydro-cracking	Lubricant Capacity	Potential Products Produced From Running Uinta Basin Waxy Crude	Distance from Uinta basin	Scale	Distance	Rail Offload	Steam Capability	Notes
Salt Lake City Refineries - Presently Served by Trucks																	
Big West Oil	North Salt Lake	Utah	32,000	8,500					-		RPPs	124	Small	Closer	N	N	
Chevron	Salt Lake City	Utah	56,000	8,500					-		RPPs	119	Small	Closer	N	N	
HollyFrontier	Woods Cross	Utah	26,400	8,400	6,000		9,000		9,000		RPPs, Extracted Base Oil, Converted Base Oil	126	Small	Closer	N	N	
Tesoro	Salt Lake City	Utah	63,000	11,400					-		RPPs	119	Small	Closer	N	N	
			177,400	**1%**													
Top-Ranked Alternate Market Locations																	
BP Cherry Point	Ferndale	Washington	236,000				65,000		65,000		Converted Base Oil	1,048	Medium	Medium	Y	N	May be difficult to reconfigure rail rack to add steam - designed for Bakken offload
BP Products	Whiting	Indiana	430,000	65,000					-		RPPs	1,347	Large	Medium			Considering rail rack with steam for offload of Canadian underdiluted bitumen blend
Calumet Specialty Products	Shreveport	Louisiana	60,000						-	12,500	Base Oil User	1,310	Small	Medium	Y	Y	Uinta yellow wax is an approved crude. Shreveport will NOT take in black wax crude.
ExxonMobil	Baton Rouge	Louisiana	523,200			27,000			27,000	16,500	Converted Base Oil, Base Oil User	1,581	Large	Distant	Y	Y	Genesis Energy Terminal, Baton Rouge 60,000 bbls/d
ExxonMobil	Baytown	Texas	584,000		47,000	29,500			29,500	28,000	Extracted Base Oil, Converted Base Oil, Base Oil User	1,412	Large	Medium	N		Better fit from refinery perspective than Baton Rounge, but have not created rail offload capability at Baytown
Marathon Petroleum	Garyville	Louisiana	574,000		38,000		117,000		117,000		Extracted Base Oil, Converted Base Oil	1,622	Large	Distant	N	N	Proposed Pinoak terminal in Garyville would be a potential fit.
Shell / PEMEX	Deer Park	Texas	340,000	24,500			60,000		60,000		RPPs, Converted Base Oil	1,338	Large	Medium	Y	Y	Kinder Morgan Deer Park rail terminal is immediately to the west of the refinery site.
Valero	Port Arthur	Texas	415,000				123,000		123,000		Converted Base Oil	1,475	Large	Medium	Y	Y	Rail offload at Valero's Lucas terminal in Beaumont
Valero	St Charles	Louisiana	220,000			28,000	70,000		98,000		Converted Base Oil	1,640	Medium	Distant	Y	Y	30,000 bbls/d rail offload at the refinery.
			3,382,200	**24%**													
Lower-Ranked Alternate Market Locations																	
Marathon Petroleum	Catlettsburg	Kentucky	292,000	31,000	13,000				-		RPPs, Extracted Base Oil	1,654	Large	Distant	N	N	
Marathon Petroleum	Galveston Bay	Texas	481,000		17,000	69,000		75,000	144,000		Extracted Base Oil, Converted Base Oil	1,439	Large	Medium	N	N	
PBF	Paulsboro	New Jersey	166,000						-	12,000	Base Oil User	2,091	Medium	Distant	Y	N	No rail at Paulsboro refinery, but can rail to PBF's Delaware City refinery and barge the oil to Paulsboro.
PBF	Delaware City	Delaware	190,200				22,300		22,300		Converted Base Oil	2,093	Medium	Distant	Y		70,000 bbls/d rail offload servicing PBF's Delaware City and Paulsboro refineries
PBF	Toledo	Ohio	188,000	51,800		52,000			52,000		RPPs, Converted Base Oil	1,636	Medium	Distant			
Phillips 66	Linden (Bayway)	New Jersey	251,000		22,000				-		Extracted Base Oil	2,106	Large	Distant	Y		75,000 bbls/d rail offload
Motiva	Port Arthur	Texas	635,000				82,000		82,000	39,000	Converted Base Oil, Base Oil User	1,475	Large	Medium	Y	N	Have own rail offload? Can be served by Jefferson (Beaumont) or GT Logistics (Port Arthur) rail terminals
Motiva	Norco (St Charles)	Louisiana	250,000				44,000		44,000		Converted Base Oil	1,640	Large	Distant			Potential rail service by IMTT (St Rose), LBC (Geismar), EnLink (St Gabriel)
Motiva	Convent	Louisiana	255,000	40,000				52,000	52,000		RPPs, Converted Base Oil	1,617	Large	Distant			Potential rail service by IMTT (St Rose), LBC (Geismar), EnLink (St Gabriel)
Valero	Corpus Christi	Texas	300,000	10,000			50,000		50,000		RPPs, Converted Base Oil	1,406	Large	Medium	Y		Trafigura Terminal in Corpus Christi 30,000 bbls/d offload
Valero	Ardmore	Oklahoma	88,000			14,000			14,000		Converted Base Oil	1,065	Small	Medium	Y		Sovereign Development rail offload in Ardmore 40,000 bbls/d offload
Valero	Meraux	Louisiana	128,000		22,000		48,700		48,700		Extracted Base Oil, Converted Base Oil	1,667	Medium	Distant			Potential rail service by IMTT (St Rose), LBC (Geismar), EnLink (St Gabriel)
Valero	Sunray	Texas	172,000	18,000	14,500		27,000		27,000		RPPs, Extracted Base Oil, Converted Base Oil	745	Medium	Closer			
Valero	Memphis	Tennessee	195,000			28,500			28,500		Converted Base Oil	1,499	Medium	Medium			
Valero	Texas City	Texas	231,000		33,500				-		Extracted Base Oil	1,402	Medium	Medium			
Valero	Houston	Texas	103,000		18,000	71,900			71,900		Extracted Base Oil, Converted Base Oil	1,389	Small	Medium			
Valero	Three Rivers	Texas	91,000	10,000	10,500		28,000		28,000	1,900	RPPs, Extracted Base Oil, Converted Base Oil, Base Oil User	1,337	Small	Medium			
			4,016,200	**29%**													

Table 9: Refinery Targets Cont'd

California Refineries - Significant Local Opposition to Crude Oil by Rail																
Chevron	El Segundo (LA)	California	290,500				53,200		53,200		Converted Base Oil	689	Large	Closer			Q's: Offload at Plains terminal in Taft, CA, ~30 miles S of Bakersfield? Could oil then go into San Joaquin Valley p/l for delivery to LA area refiners?
Chevron	Richmond (SF)	California	257,200		56,000		103,400		103,400	34,000	Extracted Base Oil, Converted Base Oil, Base Oil User	836	Large	Closer	N	N	No rail potential. Nearby Kinder Morgan Richmond crude by rail terminal mothballed. Formerly served Tesoro.
PBF	Torrance (LA)	California	157,800	18,000		23,000			23,000		RPPs, Converted Base Oil	688	Medium	Closer	Y	N	Q's: Offload at Plains terminal in Taft, CA, ~30 miles S of Bakersfield? Could oil then go into San Joaquin Valley p/l for delivery to LA area refiners?
Phillips 66	Santa Rosa	California	44,500						-			795	Small	Closer	Y	Y	SRosa processes CA heavies into intermediates piped to Rodeo (SF). Have railed black wax to Delta offload facility in Paloma and trucked from there
Phillips 66	Wilmington (LA)	California	147,000	36,200		27,500			27,500		RPPs, Converted Base Oil	764	Medium	Closer	Y	N	Q's: Offload at Plains terminal in Taft, CA, ~30 miles S of Bakersfield? Oil can then go into San Joaquin Valley p/l into LA area refiners?
Phillips 66	Rodeo (SF)	California	128,000	34,000			65,000		65,000		RPPs, Converted Base Oil	843	Medium	Closer	N	N	Phillips 66 denied refinery based crude offload facility by San Luis Obispo commission. Potential to rail & barge to refinery
Shell Oil Products	Martinez (SF)	California	158,000			42,300			42,300		Converted Base Oil	842	Medium	Closer	N	N	Nearby Kinder Morgan Richmond crude by rail terminal mothballed. Formerly served Tesoro.
Tesoro	Carson (LA)	California	276,000	43,000		55,000			55,000		RPPs, Converted Base Oil	764	Large	Closer	Y	N	Q's: Offload at Plains terminal in Taft, CA, ~30 miles S of Bakersfield? Could oil then go into San Joaquin Valley p/l for delivery to LA area refiners?
Tesoro	Wilmington (LA)	California	107,000	33,000		10,000	23,000		33,000		RPPs, Converted Base Oil	764	Small	Closer	Y	N	Q's: Offload at Plains terminal in Taft, CA, ~30 miles S of Bakersfield? Could oil then go into San Joaquin Valley p/l for delivery to LA area refiners?
Tesoro	Martinez (SF)	California	170,000				37,000		37,000		Converted Base Oil	842	Medium	Closer	N	N	Nearby Kinder Morgan Richmond crude by rail terminal mothballed. Formerly served Tesoro.
Valero	Benicia (SF)	California	149,000	37,200		34,000			34,000		RPPs, Converted Base Oil	840	Medium	Closer	N	N	Valerio denied refinery based crude offload facility by Benicia city council. Kinder Morgan Richmond crude by rail terminal mothballed
			1,885,000	**13%**													
Refinery Locations Where Uinta Crude is NOT a good fit																
BP-Husky Refining	Toledo	Ohio	160,000				31,000		31,000		Converted Base Oil	1,636	Medium	Distant	N	N	Not considering rail at Toledo
ExxonMobil	Beaumont	Texas	359,200			65,500			65,500	10,000	Converted Base Oil, Base Oil User	1,435	Large	Medium	Y	Y	XOM says this refinery not a good fit with Uinta. Rail offload available at Jefferson's crude by rail terminal across Neches River.
Fint Hills Resources	Corpus Christi	Texas	304,000			15,000			15,000		Converted Base Oil	1,406	Large	Medium			Trafigura Terminal in Corpus Christi 30,000 bbls/d offload
Fint Hills Resources	St Paul	Minnesota	339,000	13,800		50,000			50,000		RPPs, Converted Base Oil	1,321	Large	Medium			
Marathon Petroleum	Robinson	Illinois	225,000				38,000		38,000		Converted Base Oil	1,349	Medium	Medium	N	N	
Shell Oil Products	Anacortes	Washington	149,000	21,700					-		RPPs	1,030	Medium	Medium			Shelved plans for Anacortes refinery crude by rail offload in October 2016
Sinclair	Rawlings	Wyoming	90,000	14,500		15,600			15,600		RPPs, Converted Base Oil	340	Small	Closer			No crude by rail facilities. Prefer heavy sour crude diet. Does not run Uinta.
			1,626,200	**12%**													
Others - Not Evaluated or Rated																
Chevron	Pascagoula	Mississippi	360,000	34,000			117,500		117,500	25,000	RPPs, Converted Base Oil, Base Oil User	1,764	Large	Distant			Rail is nearby, short line MSE
CHS	McPherson	Kansas	89,000				38,500		38,500		Converted Base Oil	871	Small	Closer			
Citgo Petroleum	Lake Charles	Louisiana	440,000	53,200			47,400		47,400		RPPs, Converted Base Oil	1,492	Large	Medium	Y		20,000 bbls/d rail offload
PDV Midwest Refining	Lemont	Illinois	185,200	34,900					-		RPPs	1,321	Medium	Medium			
CVR	Wynnewood	Oklahoma	75,000		4,850		18,200		18,200		Extracted Base Oil, Converted Base Oil	1,049	Small	Medium			
Delek Refining	El Dorado	Arkansas	85,000		7,400				-		Extracted Base Oil	1,345	Small	Medium	Y	Y	25,000 bbls/d of light crude oil offload; or up to 12,000 bbls/d of heavy crude oil offload
HollyFrontier	El Dorado	Kansas	141,000	23,500					-		RPPs	936	Medium	Closer	Y		Savage Services transload to HollyFrontier 20,000 bbls/d
HollyFrontier	Tulsa West	Oklahoma	90,000						-	10,000	Base Oil User	1,097	Small	Medium	Y		
Hunt Refining	Tuscaloosa	Alabama	40,000				18,500		18,500		Converted Base Oil	1,728	Small	Distant	Y		$11 million crude by rail project announced in 2012
Monroe Energy	Trainer	Pennsylvania	208,000			23,000			23,000		Converted Base Oil	2,139	Medium	Distant	Y		Via barge from Enbridge's Eddystone rail terminal
Phillips 66	Ponca City	Oklahoma	218,747	53,593					-		RPPs	1,008	Medium	Medium			
Phillips 66 Excel Paralubes	Westlake	Louisiana					43,000		43,000	30,000	Converted Base Oil, Base Oil User	1,490	Small	Medium			Joint venture between Flint Hills Resources and Phillips 66
Phillips 66 WRB	Wood River	Illinois	330,000				54,000		54,000		Converted Base Oil	1,217	Large	Medium			
Philadelphia Energy Solutions	Philadelphia	Pennsylvania	355,000	86,000					-		RPPs	2,131	Large	Distant	Y		
Total Petrochem & Refining	Port Arthur	Texas	245,000		15,500				-		Extracted Base Oil	1,475	Medium	Medium	Y	Y	Can be served by Jefferson (Beaumont) or GT Logistics (Port Arthur) rail terminals
Western Refining	St Paul Park	Minnesota	97,800	24,500					-		RPPs	1,321	Small	Medium			
			2,959,747	**21%**													
Total Refining Capacity			**14,046,747**	**100%**													