

Technical Memo #2.2



## Fort Berthold Transit and Ferry Service Plan

## Technical Memorandum #2.2

Prepared for:

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## Chapter I



### INTRODUCTION

The Three Affiliated Tribes of the Fort Berthold Reservation contracted with LSC Transportation Consultants, Inc. (LSC) to develop the Transit and Ferry Service Plan. The plan will identify unmet transportation needs, evaluate service options, and prepare a recommended service plan to integrate public transit with future ferry service.



The Fort Berthold Indian Reservation is located in western North Dakota along the Missouri River and is part of six counties: McLean, Mountrail, Dunn, McKenzie, Mercer and Ward Counties. The Reservation is home to the federally recognized Mandan, Hidatsa, and Arikara Nation, also known as the Three Affiliated Tribes. The Reservation headquarters are located in New Town.

## **REPORT CONTENTS**



This Interim Report is Technical Memorandum #2.2 which presents and evaluates public transit and ferry service options and offers preliminary service recommendations. The options in this Report are presented to the

Steering Committee and community to obtain input and provide feedback and direction for the development of the plan. Preliminary recommendations are provided as a starting point for discussion.

Chapter II presents the various public transit and ferry service options with an evaluation of each option using performance measures such as the annual operating cost, number of vehicles or boats required, passengers per hour of service, and cost per passenger-trip.

Chapter III presents the preliminary recommendations for public transit and ferry service and is a starting point for discussion and selection of a preferred service plan.



# Chapter II



### INTRODUCTION

The basis for any transit service plan is the careful consideration of realistic service options. A service plan can then be developed which will refine the transit service options and facilitate implementation of a preferred service option.

This chapter examines the possible ferry and public transit service options for the Three Affiliated Tribes. These options are based on community and staff input and an assessment of existing transportation resources available to residents of the Fort Berthold Reservation.

### TRANSIT SERVICE OPTIONS

Several ferry and public transit service concepts have been developed to best meet the needs of the community. The following sections evaluate the ferry and public transit service options.

#### Ferry and Water Taxi Service Options

Lake Sakakawea and the waterways located throughout the Fort Berthold Reservation pose a transportation barrier that divides the Reservation into five segments of land that are isolated by water. The lack of connectivity between the land



segments presents hardships for those who live on the Reservation and ordinary trips such as going to work, school, or medical appointments take inordinate amounts of time. A ferry and/or water taxi service would greatly simplify travel for residents of the Fort Berthold Reservation. Several ferry and water taxi service options are presented in Table II-1 and discussed below. These options are based on the Lake Sakakawea Ferry Crossing Feasibility Study and the Water Taxi Feasibility Study completed by Ulteig, as well as input from the Steering Committee.

				Form	Tal v and Water J	ole II-1 Faxi Sorvico	Ontions							
		Total Daily Total Appual			Δηριμαί	Annual	Boat Canacity			1	,			
			# of Boats	Revenue-		Revenue-		Operating	Annual			Δηριμαί	Dassongers	Cost per
Option	Boat Type	Service Description	Required	Hours	Roundtrips	Hours	Roundtrips	Davs	Cost*	Passenger	Vehicle	Ridership*	per Hour	Passenger
Ferry Crossing at Hwy. 8		Service 7 days per week,			•		•	, .						J
, - <u> </u>		operates 8 months per year, 2												
		hr. roundtrip service for 10												
	Conventional Ferry	hours a day	1	10	5	2,427	1,213	243	\$669,841	20	14	42,467	17.5	\$15.77
		Service 7 days per week,										·	1	
		operates 12 months per year,												
		30 min. roundtrip service for 10												
	Hovercraft	hours a day	1	10	20	3,640	7,280	364	\$829,987	30	n/a	70,980	19.5	\$11.69
Ferry Crossing on Little		Service 7 days per week,												
Missouri River		operates 8 months per year, 1												
1		hr. roundtrip service for 10												
1	Conventional Ferry	hours a day	1	10	10	2,427	2,427	243	\$669,841	20	14	44,893	18.5	\$14.92
		Service 7 days per week,											1	1 1
		operates 12 months per year,												
		15 min. roundtrip service for 10												
	Hovercraft	hours a day	1	10	40	3,640	14,560	364	\$829,987	30	n/a	74,620	20.5	\$11.12
Water Taxi System	Jet boats	Weekday Service (Mon-Fri),												i
-		operates 8 months per year,												
		for 10 hours a day	2	20	n/a	3,467	n/a	173	\$335,947	14	n/a	27,733	8.0	\$12.11
		Weekend Service (Sat, Sun),										· · · · ·		
		operates 8 months per year,												
		for 10 hours a day	2	20	n/a	1,387	n/a	69	\$156,669	14	n/a	8,320	6.0	\$18.83
		TOTAL:	2	40	n/a	4,853	n/a	243	\$492,615	14	n/a	36,053	7.4	\$13.66
1	Hovercraft	Weekday Service (Mon-Fri),												
		operates 12 months per year,												
		for 10 hours a day	2	20	n/a	5,200	n/a	260	\$444,649	12	n/a	45,500	8.8	\$9.77
		Weekend Service (Sat, Sun),												
		operates 12 months per year,												
		for 10 hours a day	2	20	n/a	2,080	n/a	104	\$202,282	12	n/a	13,650	6.6	\$14.82
		TOTAL:	2	40	n/a	7,280	n/a	364	\$646,930	12	n/a	59,150	8.1	\$10.94

\* Annual operating costs and ridership demand were estimated based on the Lake Sakakawea Ferry Crossing Feasibility Study and the Water Taxi Feasibility Study.

#### Ferry Crossing at Highway 8

A ferry crossing located at old Highway 8, where the original Four Bears Bridge was previously built, would increase the accessibility of residents in the southern and eastern portions of the Reservation. The site for the north dock is located on the eastern shore of Elbowoods Bay on old Highway 8 and the site for the south dock is located approximately 4 miles north of Twin Buttes on old Highway 8. Figure II-1 illustrates the proposed route and docking locations for the Highway 8 ferry crossing and the Little Missouri River ferry crossing, which is discussed in the next section.

wo types of vessels were evaluated for a ferry crossing at this location conventional ferry and hovercraft. Conventional ferries can accommodate vehicles in addition to passengers but operate at slow speeds. Hovercraft are much faster and require less fuel to operate than conventional ferries. Hovercraft travel above the water and are ideal for shallow or icy water conditions. In addition, hovercraft can operate across land to reach sites, but have higher maintenance costs than conventional ferries. Conventional ferries can't operate more than eight months per year while hovercraft can operate 12 months per year. A conventional ferry operates at approximately 15 miles per hour, consumes 12 gallons of fuel per hour, and accommodates 14 cars and 20 passengers. The roundtrip trip time across Lake Sakakawea is approximately 2 hours for a conventional ferry, with a 30 minute crossing time and 15 minute unloading time on each side of the lake. A hovercraft operates at approximately 40 miles per hour, consumes 15 gallons of fuel per hour, and accommodates 30 passengers. The roundtrip trip time across Lake Sakakawea is approximate 30 minutes for a hovercraft.

This proposed ferry option using a conventional ferry would result in the following operational cost and riders:

- Number of boats: 1
- Capital costs: \$16,433,000
  - Conventional Ferry: \$6,089,000
  - > Terminals (including variable costs): \$10,344,000
- Annual operating cost: \$669,841
- Annual estimated ridership: 42,467



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- Average cost per passenger: \$15.77
- Passengers per hour: 17.5

This proposed ferry option using a hovercraft would result in the following operational cost and riders:

- Number of boats: 1
- Capital costs: \$13,054,000
  - Hovercraft: \$4,000,000 (Costs for hovercraft very greatly based on desired specifications. The Air Form AF 46 Hovercraft is similar in size and has a base price of \$2,800,000; <u>http://www.airform.co/af46.html</u>)
  - Terminals (including variable costs): \$9,054,000
- Annual operating cost: \$829,987
- Annual estimated ridership: 70,980
- Average cost per passenger: \$11.69
- Passengers per hour: 19.5

#### Ferry Crossing on the Little Missouri River

A ferry crossing along the Little Missouri River would increase the accessibility of residents in the southern and western portions of the Reservation. The site for the north dock is near the Moccasin Bay Public Use Area located on BIA Road, approximately 20 miles from Mandaree. The site for the south dock is located on the Little Missouri River to the west of Charging Eagle Bay, approximately 13 miles north of Twin Buttes. Figure II-1 illustrates the proposed route and docking locations for the Little Missouri River ferry crossing and the Highway 8 ferry crossing, which was discussed in the previous section.

Like the ferry crossing option at Highway 8, two types of vessels were evaluated for a ferry crossing on the Little Missouri River - conventional ferry and hovercraft. Conventional ferries can accommodate vehicles in addition to passengers but operate at slow speeds. Hovercraft are much faster and require less fuel to operate than conventional ferries. Hovercraft travel above the water and are ideal for shallow or icy water conditions. In addition, hovercraft can operate across land to reach sites, but have higher maintenance costs than conventional ferries. Conventional ferries are only able to operate eight months per year while hovercraft can operate 12 months per year. A conventional ferry operates at approximately 15 miles per hour, consumes 12 gallons of fuel per hour, and accommodates 14 cars and 20 passengers. The roundtrip trip time across the Little Missouri River is approximately one hour for a conventional ferry. A hovercraft operates at approximately 40 miles per hour, consumes 15 gallons of fuel per hour, and accommodates 30 passengers. The roundtrip trip time across the Little Missouri River is approximate 15 minutes for a hovercraft.

This proposed ferry option using a conventional ferry would result in the following operational cost and riders:

- Number of boats: 1
- Capital costs: \$16,433,000
  - Conventional Ferry: \$6,089,000
  - > Terminals (including variable costs): \$10,344,000
- Annual operating cost: \$669,841
- Annual estimated ridership: 44,893
- Average cost per passenger: \$14.92
- Passengers per hour: 18.5

This proposed ferry option using a hovercraft would result in the following operational cost and riders:

- Number of boats: 1
- Capital costs: \$13,054,000
  - Hovercraft: \$4,000,000 (Costs for hovercraft very greatly based on desired specifications. The Air Form AF 46 Hovercraft is similar in size and has a base price of \$2,800,000; <u>http://www.airform.co/af46.html</u>)
  - > Terminals (including variable costs): \$9,054,000
- Annual operating cost: \$829,987
- Annual estimated ridership: 74,620
- Average cost per passenger: \$11.12
- Passengers per hour: 20.5

#### Water Taxi System

A water taxi system on Lake Sakakawea and on waterways throughout the study area would offer Fort Berthold residents a high-speed transportation option thereby improving mobility and increasing accessibility throughout the region.

Docks for water taxis are less expensive than those required for car or larger passenger ferries. The estimated cost of a water taxi dock is approximately \$200,000 to \$400,000. There are a number of existing docks on Lake Sakakawea that could be used for a water taxi system, as shown in Figure II-2.



This option considers water taxi service with jet boats and with hovercraft. Both options, jet boats or hovercraft, offer passengers high speed transportation throughout the study area. Small

jet boats operate at approximately 46 miles per hour, consume 7 gallons of fuel per hour, and accommodate 14 passengers. Small hovercraft operate at approximately 40 miles per hour, consume 10 gallons of fuel per hour, and accommodate 12 passengers. Jet boats would require dock access while hovercraft would not since they can land on the ground. Hovercraft are

beneficial in areas where water depth or ice can be problematic, but can be difficult to maneuver in high wind areas. Hovercraft also have higher maintenance costs than other traditional types of vessels.



A water taxi system using jet boats would result in the following operational cost and riders:

- Number of boats: 3 (two in operation and one spare)
- Capital costs: \$600,000 + additional costs for new docks
  - Jet boats: \$200,000 per vessel (Jet boat costs very greatly based on desired specifications. A Keelow Craft Boats 13 passenger jetboat costs \$160,000; <u>http://keelowcraft.co.nz/custom-tour-jetboats/pricing</u>)
  - Docks: No cost if using existing docks. A new jet boat dock costs between \$200,000 and \$400,000.
- Annual operating cost: \$492,615
- Annual estimated ridership: 36,053



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- Average cost per passenger: \$13.66
- Passengers per hour: 7.4

A water taxi system using hovercraft would result in the following operational cost and riders:

- Number of boats: 3 (two in operation and one spare)
- Capital costs: \$3,000,000
  - Hovercraft: \$1,000,000 per vessel (Costs for hovercraft very greatly based on desired specifications. The Air Form AF 18 Hovercraft is similar in size and has a base price of \$850,000; <u>http://www.airform.co/af18.html</u>)
  - > Docks: No cost if using existing docks.
- Annual operating cost: \$646,930
- Annual estimated ridership: 59,150
- Average cost per passenger: \$10.94
- Passengers per hour: 8.1

#### **Public Transit Service Options**

The public transit service options were designed to operate separately or in conjunction with the ferry and water taxi service options. The public transit service options have been designed to improve the connectivity between the five segments and to make work, school, and medical trips easier for residents across the Fort Berthold Reservation. The public transit service options are presented in Table II-2 and discussed below.

#### Fixed-Route Service between Twin Buttes and New Town

This option looks at creating fixed-route transit service between Twin Buttes and New Town, with a stop in Mandaree, as shown in Figure II-3. The roundtrip distance is approximately 206 miles with a roundtrip time of about four and a half hours. The fixed-route transit service between Twin Buttes and New Town would operate two roundtrips a day, seven days per week.

- Number of vehicles: 1
- Annual operating cost: \$161,441

			Table II	-2							
		Public	Transit Ser	vice Option	ns						-
		# of	Total	Daily	Total A	Annual	Annual	Annual			
		Vehicles	Revenue -	Revenue -	Revenue -	Revenue -	Operating	Operating	Annual	Passengers	Cost per
Option	Service Description	Required	Miles	Hours	Miles	Hours	Days	Cost*	Ridership	per Hour	Passenger
Fixed-Route between Twin Buttes	Weekday service (Mon-Fri), 4.5 hour										
and New Town	roundtrip trip time, 2 roundtrips per day	1	412	9	107,120	2,340	260	\$115,315	8,850	3.8	\$13.03
	Weekend service (Sat, Sun), 4.5 hour										
	roundtrip trip time, 2 roundtrips per day	1	412	9	42,848	936	104	\$46,126	2,950	3.2	\$15.64
	TOTAL:	1	824	18	149,968	3,276	364	\$161,441	11,800	3.6	\$13.68
Fixed-Route between Mandaree and	Weekday service (Mon-Fri), 1.5 hour										
New Town	roundtrip trip time, 6 roundtrips per day	1	384	9	99,840	2,340	260	\$115,315	15,315	6.5	\$7.53
	Weekend service (Sat, Sun), 1.5 hour										
	roundtrip trip time, 6 roundtrips per day	1	384	9	39,936	936	104	\$46,126	5,105	5.5	\$9.04
	TOTAL:	1	768	18	139,776	3,276	364	\$161,441	20,420	6.2	\$7.91
Fixed-Route between White Shield,	Weekday service (Mon-Fri), 2.5 hour										
Parshall, and New Town	roundtrip trip time, 4 roundtrips per day	1	456	10	118,560	2,600	260	\$128,128	6,000	2.3	\$21.35
	Weekend service (Sat, Sun), 2.5 hour										
	roundtrip trip time, 4 roundtrips per day	1	456	10	47,424	1,040	104	\$51,251	2,000	1.9	\$25.63
	TOTAL:	1	912	20	165,984	3,640	364	\$179,379	8,000	2.2	\$22.42
Demand Response Service	Weekday service (Mon-Fri), four vehicles										
supporting water taxi system	operating 10 hours a day	4	320	40	83,200	10,400	260	\$512,512	15,400	1.5	\$33.28
Fixed-route connections from ferry											
terminals:											
Hwy. 8 Ferry Crossing North Dock to	Mon-Fri Service; 60 min. roundtrip trip time,										
White Shield	operating 10 hours a day	1	320	10	83,200	2,600	260	\$128,128	8,846	3.4	\$14.48
Hwy. 8 Ferry Crossing North Dock to	Mon-Fri Service; 2 hr. roundtrip trip time,										
New Town	operating 10 hours a day	1	440	10	114,400	2,600	260	\$128,128	6,000	2.3	\$21.35
Hwy. 8 Ferry Crossing South Dock to	Mon-Fri Service; 30 min. roundtrip trip time,										
Twin Buttes	operating 10 hours a day	1	240	10	62,400	2,600	260	\$128,128	7,154	2.8	\$17.91
Little Missouri River Ferry Crossing	Mon-Fri Service; 3 hr. roundtrip trip time, 2										
North Dock to New Town	vehicles operating 3 roundtrips per day	2	840	18	218,400	4,680	260	\$230,630	8,099	1.7	\$28.48
Little Missouri River Ferry Crossing	Mon-Fri Service; 1.5 hr. roundtrip trip time,										
South Dock to Twin Buttes	operating 10.5 hours a day	1	182	7	47,320	1,820	260	\$89,690	6,701	3.7	\$13.38
* Annual operating costs were estimated based or	n the average operating cost per hour from the 2015 NTD i	Data Tables fo	or North Dakota		-	•	-	-	•	•	-



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- Annual estimated ridership: 11,800
- Average cost per passenger: \$13.68
- Passengers per hour: 3.6

#### Fixed-Route Service between Mandaree and New Town

This option looks at creating fixed-route transit service between Mandaree and New Town, as shown in Figure II-4. The roundtrip distance is approximately 64 miles with a roundtrip time of about one and a half hours. The fixed-route transit service between Mandaree and New Town would operate six roundtrips a day, seven days per week.

- Number of vehicles: 1
- Annual operating cost: \$161,441
- Annual estimated ridership: 20,420
- Average cost per passenger: \$7.91
- Passengers per hour: 6.2



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#### Fixed-Route Service between White Shield, Parshall, and New Town

This option looks at creating fixed-route transit service between White Shield, Parshall, and New Town, as shown in Figure II-5. The roundtrip distance is approximately 114 miles with a roundtrip time of about two and a half hours. The fixed-route transit service between White Shield, Parshall, and New Town would operate four roundtrips a day, seven days per week.

- Number of vehicles: 1
- Annual operating cost: \$179,379
- Annual estimated ridership: 8,000
- Average cost per passenger: \$22.42
- Passengers per hour: 2.2



#### Demand Response Service Supporting Water Taxi System

This option looks at creating a demand response service on the Fort Berthold Reservation that would support a water taxi system. The demand response service would operate 10 hours a day, Monday through Friday. Four vehicles would be used for this service and they would be located in Mandaree, New Town, Twin Buttes, and White Shield. Figure II-6 illustrates the existing docks for the water taxi system and the demand response service areas.

- Number of vehicles: 4
- Annual operating cost: \$512,512
- Annual estimated ridership: 15,400
- Average cost per passenger: \$33.28
- Passengers per hour: 1.5



#### Fixed-Route Service Providing Connections from Ferry Docks

The following options look at implementing fixed-route transit service to provide connections to and from the proposed ferry dock locations.

#### Hwy. 8 Ferry Crossing North Dock to White Shield

This option looks at creating fixed-route transit service between the north dock of the Highway 8 ferry crossing and White Shield, as shown in Figure II-7. The roundtrip distance is approximately 32 miles with a roundtrip time of about 60 minutes. The fixed-route transit service between the north dock of the Highway 8 ferry crossing and White Shield would operate 10 hours per day, Monday through Friday.

- Number of vehicles: 1
- Annual operating cost: \$128,128
- Annual estimated ridership: 8,846
- Average cost per passenger: \$14.48
- Passengers per hour: 3.4



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#### Hwy. 8 Ferry Crossing North Dock to New Town

This option looks at creating fixed-route transit service between the north dock of the Highway 8 ferry crossing and New Town, with a stop in Parshall, as shown in Figure II-8. The roundtrip distance is approximately 88 miles with a roundtrip time of about 2 hours. The fixed-route transit service between the north dock of the Highway 8 ferry crossing, Parshall, and New Town would operate 10 hours per day, Monday through Friday.

- Number of vehicles: 1
- Annual operating cost: \$128,128
- Annual estimated ridership: 6,000
- Average cost per passenger: \$21.35
- Passengers per hour: 2.3



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#### Hwy. 8 Ferry Crossing South Dock to Twin Buttes

This option looks at creating fixed-route transit service between the south dock of the Highway 8 ferry crossing and Twin Buttes, as shown in Figure II-9. The roundtrip distance is approximately 12 miles with a roundtrip time of about 30 minutes. The fixed-route transit service between the south dock of the Highway 8 ferry crossing and Twin Buttes would operate 10 hours per day, Monday through Friday.

- Number of vehicles: 1
- Annual operating cost: \$128,128
- Annual estimated ridership: 7,154
- Average cost per passenger: \$17.91
- Passengers per hour: 2.8



#### Little Missouri River Ferry Crossing North Dock to New Town

This option looks at creating fixed-route transit service between the north dock of the Little Missouri River ferry crossing, Mandaree, and New Town, as shown in Figure II-10. The roundtrip distance is approximately 140 miles with a roundtrip time of about three hours. The fixed-route transit service between the north dock of the Little Missouri River ferry crossing, Mandaree, and New Town would be run by two vehicles, each operating three roundtrips per day, Monday through Friday.

- Number of vehicles: 2
- Annual operating cost: \$230,630
- Annual estimated ridership: 8,099
- Average cost per passenger: \$28.48
- Passengers per hour: 1.7



#### Little Missouri River Ferry Crossing South Dock to Twin Buttes

This option looks at creating fixed-route transit service between the south dock of the Little Missouri River ferry crossing and Twin Buttes, as shown in Figure II-11. The roundtrip distance is approximately 26 miles with a roundtrip time of one and a half hours. The fixed-route transit service between the south dock of the Little Missouri River ferry crossing and Twin Buttes would operate 10.5 hours per day, Monday through Friday.

- Number of vehicles: 1
- Annual operating cost: \$89,690
- Annual estimated ridership: 6,701
- Average cost per passenger: \$13.38
- Passengers per hour: 3.7



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## Chapter 3



## **Preliminary Recommendations**

### INTRODUCTION

LSC has prepared a set of preliminary recommendations based on the analysis of the various service alternatives presented in Chapter II. The recommendations will be reviewed by the Steering Committee and the public. Preliminary recommendations are provided as a starting point for discussion. Following this review and the corresponding input, LSC will develop a service plan that incorporates the preferred service alternatives to best meet the community's needs.

### RECOMMENDED SERVICE PLAN

The preliminary recommended service plan includes recommendations for ferry, water taxi, and public transit service on the Fort Berthold Reservation in three phases. The recommended service plan is presented in Table III-1.

#### Phase I

Phase I creates three weekday fixed-route bus routes on the Fort Berthold Reservation. As shown in Figure III-1, the three routes would operate between:

- Twin Buttes and New Town, also stopping in Mandaree and Four Bears Village
- 2) Mandaree and New Town, also stopping in Four Bears
- 3) White Shield to New Town, also stopping in Parshall

LSC recommends the Three Affiliated Tribes consolidate their existing Tribal segment vehicles and use them to implement Phase I fixed-route transit services. Presently, the Tribal vehicles are being underused and would serve more residents of the Fort Berthold Reservation if used for fixed-route transit services. Using existing Tribal vehicles would also eliminate any capital costs incurred from acquiring new vehicles.

	Table III-1       Preliminary Recommended Service Plan											
			# of Vehicles/	Total	Daily	Total	Annual	Δηημαί	Δηριμαί		<b>I</b>	
			Vessels	Revenue	Revenue	Revenue	Revenue	Operating	Operating	Annual	Passengers	Cost per
	Type of Service	Service Description	Required	Miles	Hours	Miles	Hours	Days	Cost	Ridership	per Hour	Passenger
1	Fixed-Route bus service between Twin	Weekday service (Mon-Fri), 4.5 hour roundtrip trip										
	Buttes and New Town	time, 2 roundtrips per day	1	412	9	107,120	2,340	260	\$115,315	8,850	3.8	\$13.03
	Fixed-Route bus service between Mandaree	Weekday service (Mon-Fri), 1.5 hour roundtrip trip										
	and New Town	time, 6 roundtrips per day	1	384	9	99,840	2,340	260	\$115,315	15,315	6.5	\$7.53
	Fixed-Route bus service between White	Weekday service (Mon-Fri), 2.5 hour roundtrip trip										
	Shield, Parshall, and New Town	time, 4 roundtrips per day	1	456	10	118,560	2,600	260	\$128,128	6,000	2.3	\$21.35
		TOTAL:	3	1,252	28	325,520	7,280	260	\$358,758	30,165	4.1	\$11.89
2	Hovercraft water taxi system	Weekday service (Mon-Fri), operates 12 months per year, for 10 hours a day	2	20	n/a	5,200	n/a	260	\$527,950	45,500	8.8	\$11.60
	Demand response service supporting water	Weekday service (Mon-Fri), four vehicles operating				,			,	,		
	taxi system	10 hours a day	4	320	40	83,200	10,400	260	\$512,512	15,400	1.5	\$33.28
3	Hovercraft water taxi system	Weekday service (Mon-Fri), operates 12 months per year, for 10 hours a day	2	20	n/a	5,200	n/a	260	\$527,950	45,500	8.8	\$11.60
	Demand response service supporting water	Weekday service (Mon-Fri), four vehicles operating										
	taxi system and ferry crossing	10 hours a day	4	320	40	83,200	10,400	260	\$512,512	15,400	1.5	\$33.28
	Hovercraft Ferry Crossing at Hwy 8	Service 7 days per week, operates 12 months per year, 30 min. roundtrip service for 10 hours a day	1	10	20	3,640	7,280	364	\$829,987	70,980	19.5	\$11.69
	Fixed-route connection from Hwy. 8 Ferry Crossing North Dock to New Town	Weekday service (Mon-Fri), 2 hr. roundtrip trip time, operating 10 hours a day	1	440	10	114,400	2,600	260	\$128,128	6,000	2.3	\$21.35
	Fixed-route connection from Hwy 8 Ferry Crossing South Dock to Twin Buttes	Weekday service (Mon-Fri), 30 min. roundtrip trip time, operating 10 hours a day	1	240	10	62,400	2,600	260	\$128,128	7,154	2.8	\$17.91
Note: The and vess	e annual operating costs and ridership demand for the fer el maintenance. The annual operating costs for bus public	ry and water taxi services were estimated based on the Lake Sakak c transit were estimated based on the average operating cost per ho	awea Ferry Crossing ur from the 2015 NTD	Feasibility Stud Data Tables f	dy and the Wa or North Dako	ter Taxi Feasib ta.	oility Study. The	e annual operatir	ng costs for the fer	ry and water tax	xi services include	overhead costs



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Phase I would result in the following operational cost, riders, and vehicles:

- Number of vehicles required: 3
- Capital costs: no cost if existing Tribal vehicles are used
- Annual operating cost: \$358,758
- Annual estimated ridership: 30,165
- Average cost per passenger: \$11.89
- Passengers per hour: 4.1

#### Phase II

Phase II eliminates Phase I fixed-route bus services and begins a new hovercraft water taxi system with supporting demand response bus service. The demand response bus service should be operated using the existing Tribal vehicles used for Phase I. A hovercraft water taxi system offers Fort Berthold



residents a high speed transportation option thereby improving mobility and increasing accessibility throughout the entire Reservation. Phase II services would operate on weekdays, year-round, for 10 hours a day. While hovercraft have higher capital and maintenance costs than more traditional vessels, they are able to operate 12 months per year, have the flexibility to land on water or land, and are ideal for shallow or icy water conditions.

Using existing docks and boat ramps on Lake Sakakawea and on waterways throughout the study area would eliminate any capital costs incurred from building new docks. Figure III-2 illustrates all of the existing docks on Lake Sakakawea and on waterways throughout the study area that could be used for the water taxi system. If additional docks are necessary, the estimated cost of a new water taxi dock is approximately \$200,000 to \$400,000.

Phase II would result in the following operational cost, riders, and vehicles:

- Number of vehicles required: 4 (Located in Mandaree, New Town, Twin Buttes, and White Shield)
- Number of vessels required: 3 (two in operation and one spare)



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- Capital costs: \$3,000,000
  - Hovercraft: \$1,000,000 per vessel x 3 vessels (Costs for hovercraft very greatly based on desired specifications. The Air Form AF 18 Hovercraft is similar in size and has a base price of \$850,000; http://www.airform.co/af18.html)
  - > Docks: no cost if existing docks are used.
  - > Vehicles: no cost if existing Tribal vehicles are used.
- Annual operating cost: \$983,711
  - ➢ Hovercraft: \$471,199
  - Demand Response Service: \$512,512
- Annual estimated ridership:
  - ▶ Hovercraft: 45,500
  - Demand Response Service: 15,400
- Average cost per passenger:
  - ➢ Hovercraft: \$9.77
  - Demand Response Service: \$33.28
- Passengers per hour:
  - ➢ Hovercraft: 8.8
  - > Demand Response Service: 1.5

#### Phase III



Phase III maintains the hovercraft water taxi system with supporting demand response bus service from Phase II, and adds a new hovercraft ferry crossing at old Highway 8 with supporting fixed-route bus service from both of the ferry terminals, as shown in Figure III-3. The demand response and fixed-route bus

services should be operated using existing Tribal vehicles. Though hovercraft have higher capital and maintenance costs than more traditional vessels, they are beneficial as they are able to operate 12 months per year, have the flexibility to land on water or land, and are ideal for shallow or icy water conditions.

The hovercraft water taxi system with supporting demand response bus service would continue to operate on weekdays, year-round, for 10 hours a day. The hovercraft ferry crossing at old Highway 8 would operate seven days a week, year-round, for 10 hours a day. The supporting fixed-route bus services from the two ferry terminals would operate on weekdays, year-round, for 10 hours a day.



Fort Berthold Transit and Ferry Service Plan, Technical Memorandum #2.2

Continuing to use existing docks and boat ramps on Lake Sakakawea and on waterways throughout the study area for the water taxi service would eliminate any capital costs incurred from building new water taxi docks. If additional docks are necessary, the estimated cost of a new water taxi dock is approximately \$200,000 to \$400,000.

Phase III would result in the following operational cost, riders, and vehicles:

- Number of vehicles required: 6
  - Demand response service: 4
  - > Fixed-route bus service from both ferry terminals: 2
- Number of vessels required: 4
  - > Water taxi hovercraft: 3 (two in operation and one spare)
  - Ferry crossing hovercraft: 1
- Capital costs: \$14,054,000
  - Water taxi hovercraft: \$1,000,000 per vessel x 3 vessels (Costs for hovercraft very greatly based on desired specifications. The Air Form AF 18 Hovercraft is similar in size and has a base price of \$850,000; <u>http://www.airform.co/af18.html</u>)
  - > Water taxi docks: none if existing docks are used.
  - Demand response vehicles: no cost if existing Tribal vehicles are used.
  - Ferry crossing hovercraft: \$4,000,000 (Costs for hovercraft very greatly based on desired specifications. The Air Form AF 46 Hovercraft is similar in size and has a base price of \$2,800,000; <u>http://www.airform.co/af46.html</u>)
  - > Ferry crossing terminals (including variable costs): \$9,054,000
  - Fixed-route bus service from both ferry terminals: no cost if existing Tribal vehicles are used.
- Annual operating cost: \$2,069,954
  - ➢ Water taxi hovercraft: \$471,199
  - > Demand response service: \$512,512
  - Ferry crossing hovercraft: \$829,987
  - > Fixed-route bus service from both ferry terminals: \$256,256
- Annual estimated ridership:
  - ➢ Water taxi hovercraft: 45,500
  - Demand response service: 15,400
  - Ferry crossing hovercraft: 70,980
  - > Fixed-route bus service from both ferry terminals: 13,154

- Average cost per passenger:
  - ➢ Water taxi hovercraft: \$9.77
  - > Demand response service: \$33.28
  - Ferry crossing hovercraft: \$11.69
  - ▶ Fixed-route bus service from both ferry terminals: \$19.48
- Passengers per hour:
  - ➢ Water taxi hovercraft: 8.8
  - Demand response service: 1.5
  - ➢ Ferry crossing hovercraft: 19.5
  - > Fixed-route bus service from both ferry terminals: 2.5