



# Bore Tides 2011

## An International Phenomenon

Bore Tides have been described as breaking waves as high as 26 feet, sounding like locomotive trains, foaming and frothing along at speeds between 6 and 24 miles per hour. Tidal bores are anything but BORING!

There are more than 60 locations worldwide where tidal bores can be seen. The highest bore, called the pororoca, is located in the Amazon basin and can be 25 feet tall. This particular bore will also span across several miles of river. The effects of this bore have been noted as far as 500 miles upriver. China's Tsientang River bore is considered one of the strongest bores, barreling up the river at between 18 and 24 MPH near the city of Hangchow. The British Severn River bore disturbs the bottom-dwelling eels as it rushes up the river, which allows local residents to catch the eels in their nets as the river begins to flow downstream again.

In North America, bores have been recorded in the Bay of Fundy (Nova Scotia), the Colorado River (Mexico), and Alaska. The Colorado River bore has practically disappeared due to reclamation projects which include a series of dams in the Colorado River to regulate the flow.

### The Alaskan Tidal Bore

The only locations in the United States where tidal bores occur regularly

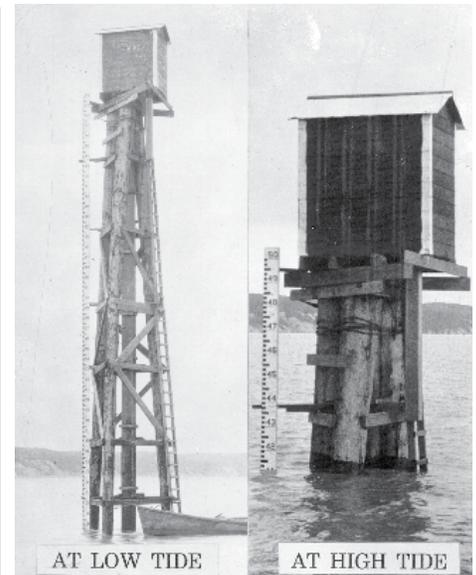


are Turnagain and Knik Arms. The Turnagain Arm bore, according to Susan Bartsch-Winkler (USGS), who has studied the sedimentology of the intertidal zones of both Knik and Turnagain Arms, are a daily occurrence. On days with small tidal fluctuations you have to look a little harder, but there will be a bore down a channel somewhere in the arm.

To understand the nature of a bore one must first examine the environment necessary to create such a phenomenon. Both Turnagain and Knik Arms are uniquely suited for the formation of tidal bores for two major reasons:

1. They are both adjacent to a body of water with a large range in tide (Cook Inlet, 35 feet+).
2. Their configurations are, by comparison to Cook Inlet, narrow, shallow, and gently sloping, forcing the rapidly rising tidewaters to form a tidal flood with a raised abrupt front.

The extreme range in tide in Cook Inlet can be attributed to the natural resonance of the inlet being nearly equal to the daily tidal interval of 12

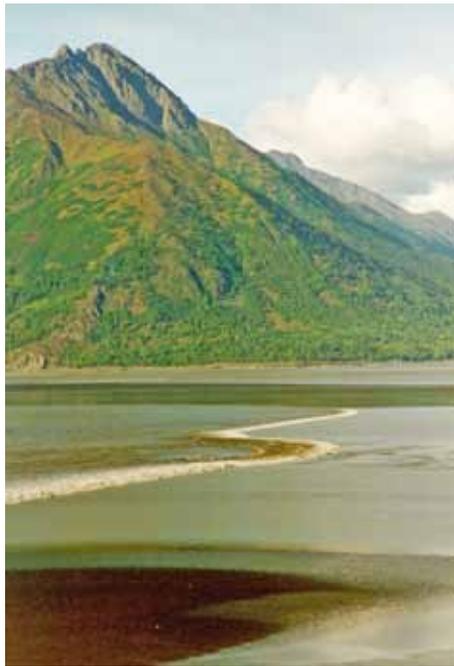


Historic photographs of extreme high and low tides in Anchorage (NOAA photo)

hours and 25 minutes. Every basin of water has a natural resonance, that is, a natural vibration associated with the time it takes the water to slosh back and forth from one end of the basin to the other. (Both Cook Inlet and the Bay of Fundy's tidal ranges are amplified to phenomenal heights due to the combined tide and resonant effects.)

## Some Characteristics of Alaska's Tidal Bores

- It takes 5 ½ hours for the tidal bore to travel from the mouth of the Turnagain Arm to the end of the arm (it forms at the mouth within one hour after each predicted low tide in Anchorage).
- The tidal bore in Knik Arm is not as common as the Turnagain Arm bore but is definitely worth noting. In 1974, NOAA (National Oceanic and Atmospheric Administration) set up a “bore watch” in Knik Arm to verify or disprove statements that the Knik Arm bore had disappeared. NOAA Ship Rainer’s personnel were able to witness bores on two separate occasions just north of Goose Bay, in Knik, and near Bay City. These bore tides were noted on days with minus tides of (-)4.5 feet or less. The bores were apparent approximately 1 ½ hours after predicted low tide in Anchorage.
- The Knik Arm bore has also been viewed from the village of Knik approximately three hours after predicted low tide in Anchorage.
- The size and speed of the Alaska bore tides, and the Knik Arm bore tide in particular, have changed since the 1964 earthquake, due to drastic change in bottom configuration. The land subsided and created deeper channels which produce smaller bores.
- In Turnagain Arm, bores range in size from ½ foot to 6 feet high and travel at speeds between 10 to 15 MPH. Knik Arm bore size and speed are on the low end of those figures.
- A bore tide can be seen nearly every day somewhere in Turnagain Arm just after low tide. Its size depends on the range of the tide for that day. The most dramatic bore tides occur during days with extreme minus tides (between -2.0 feet and -5.5 feet).



Bore Tide moving up Turnagain Arm

- Opposing winds enhance the bore tide (i.e., winds blowing from Portage to Anchorage).
- The ever-changing channels throughout the arms dictate the size of the bores and the best points from which to view them.
- As you follow the bore up the channels from the Indian Creek side of Turnagain Arm, you can also see the bore breaking on the side of the arm near Hope.
- The larger bores can be heard with a sound similar to that of a train.

### Tidal Bore Tales

For those Alaskans who are fortunate enough to either live or spend a great deal of their time along Turnagain Arm, tidal bore stories are a common topic of conversation.

One such person is Doug Fesler, who works for Alaska State Parks and has lived in Bird Creek since 1975. *He remembers seeing a large bull moose out on the tidal flats of Turnagain Arm on an afternoon in October 1978. The bore was rather large that day and could*

*be heard and seen rushing toward the moose. Frightened and confused, the moose tried unsuccessfully to outrun the bore. The frothing water picked him up and carried him along with it for a few hundred yards until the moose simply disappeared below the white water never to surface again. He has also seen windsurfers barely escape the bore at Beluga Point. The power of these waves should not be underestimated.*

*Sea gulls often fly along the bore tide looking for small fish in the white water. Beluga whales have been seen playing as it forms near the mouth of the arm. Many a hooligan fisherman has been surprised by the bore tide as it breaks along the shores of Turnagain Arm. It is highly recommended that recreators stay clear of this powerful phenomenon. The best advice is not to be in the water or near the shore shortly after low tide, especially during an extremely low tide.*

### Planning to see a Turnagain Arm Bore Tide

Planning a bore tide sighting is easier than you may think. With some general knowledge about bore tides and a tide table for Anchorage, one can witness many bores in Turnagain Arm throughout the year.

Follow these guidelines to make your bore tide field trip worthwhile:

1. Choose the new or full moon periods during the month to catch extreme tides.
2. Once you identify specific time periods with extreme tides, look for a day when the predicted tide range for Anchorage includes large negative values for low tide.
3. Find yourself a good vantage point between McHugh Creek and Indian Creek or at Hope Campground for watching a tidal bore.
4. The bore should reach the pullout near Indian Creek on the Seward Highway approximately 1 ½ hours past predicted low tide in

Anchorage.

5. Knowing the bore travels about 10 to 15 MPH, you can estimate when it will be at other locations in the inlet.
6. You should be at your chosen vantage point at least 1/2 hour before you expect the bore to arrive.
7. The water will seem calm and uneventful just prior to the bore arrival.
8. Look and listen for a series of undulant waves two to three feet apart which may be breaking along the shore.

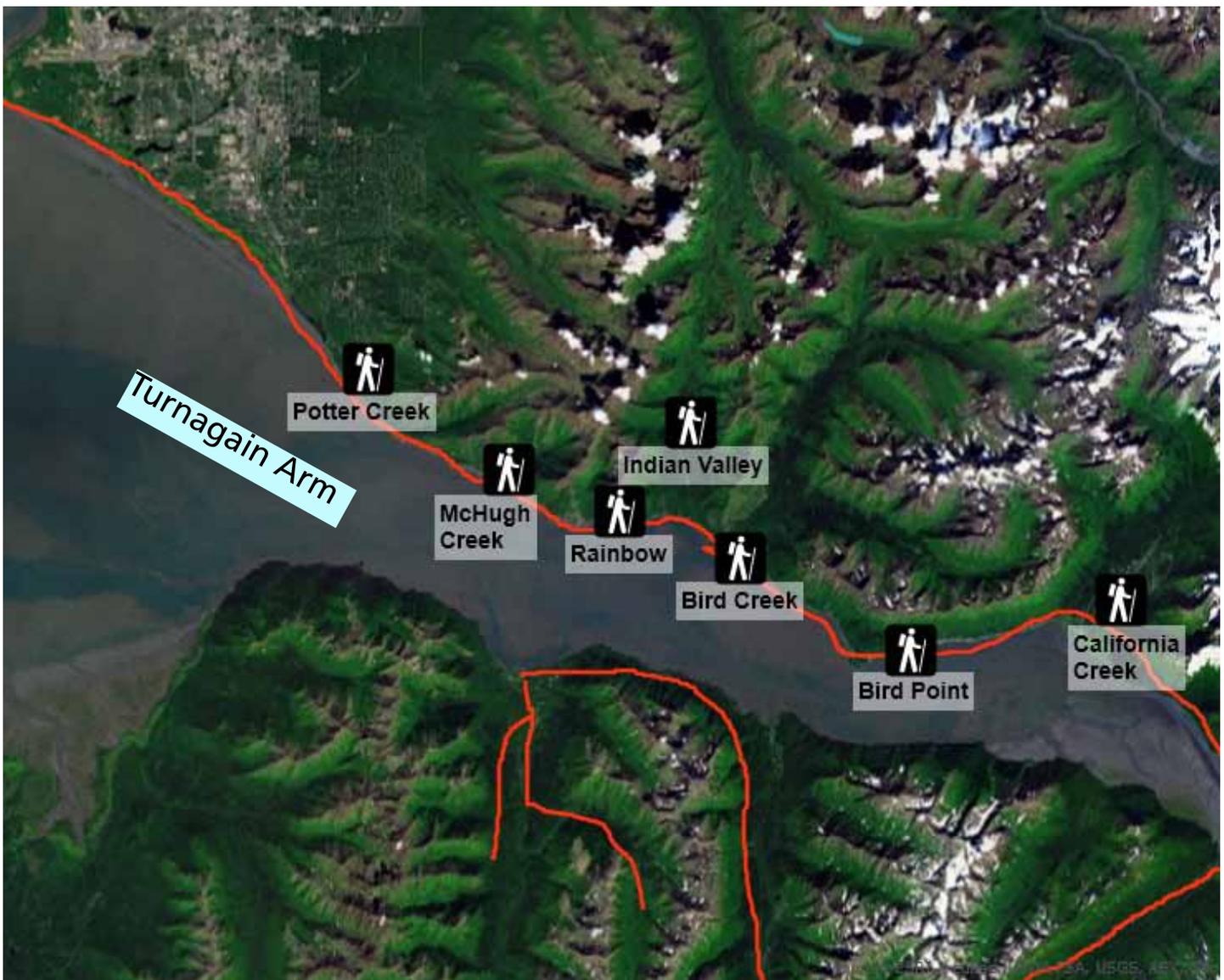
## Bore Tides on Turnagain Arm

Times in hours and minutes following low tide in Anchorage: (approximate)  
>Beluga Point 1 hour 15 minutes  
>Indian Point 1 hour 30 minutes  
>Bird Point 2 hours 15 minutes  
>Girdwood 3 hours  
(Differences in the wind and tide range can affect the time and height of the bore tide)

To see the most dramatic bore tides choose the new or full moon periods and a day when there is a large negative value for low tide. Bore tides may be observed in the Turnagain Arm by driving from Anchorage towards

Portage on the Seward Highway. Plan on arriving just prior to the times listed above at each of the locations noted. Look for a breaking wave or a series of standing waves moving up the Arm. It will change shape as it moves, breaking in the shallows and forming standing waves over the deeper channels. If you arrive at one of the viewing points and water is already flowing up the Arm toward Portage, the bore has passed. Continue driving on to the next location until you either catch up to the tidal bore or the water returns to flowing down the Arm toward Anchorage. Stop and wait, the bore tide will be along shortly.

•Adapted from Alaska Bore Tales by M. Mochan-Douthit, NOAA Alaska Region



# ANCHORAGE (Knik Arm) BORE TIDE TABLE 2011

May 2011 Low Tides					
Date	A.M.	Feet	P.M.	Feet	
1	S	1:19	3.9	1:53	<b>-0.4</b>
2	M	1:57	3.9	2:28	<b>-0.9</b>
3	T	2:33	4.2	3:03	<b>-1.2</b>
4	W	3:07	4.6	3:37	<b>-1.4</b>
5	T	3:40	5.0	4:12	<b>-1.4</b>
6	F	4:14	5.5	4:48	<b>-1.1</b>
7	S	4:50	5.9	5:26	<b>-0.6</b>
8	S	5:31	6.4	6:08	0.1
9	M	6:18	6.8	6:54	1.0
10	T	7:13	6.9	7:47	1.9
11	W	8:21	6.3	8:51	2.7
12	T	9:44	4.5	10:01	2.8
13	F	10:58	1.9	11:07	2.8
14	S	---	---	12:05	<b>-0.4</b>
15	S	0:12	2.7	1:06	<b>-2.3</b>
16	M	1:13	2.7	1:59	<b>-3.6</b>
17	T	2:06	2.7	2:48	<b>-4.1</b>
18	W	2:54	2.8	3:33	<b>-4.0</b>
19	T	3:40	3.2	4:15	<b>-3.3</b>
20	F	4:23	3.8	4:55	<b>-2.2</b>
21	S	5:05	4.7	5:33	<b>-0.8</b>
22	S	5:48	5.8	6:10	0.8
23	M	6:34	6.7	6:51	2.4
24	T	7:30	7.3	7:39	4.1
25	W	8:42	6.9	8:39	5.6
26	T	9:52	5.5	9:46	6.3
27	F	10:55	3.6	10:51	6.5
28	S	11:51	1.7	11:51	6.2
29	S	---	---	12:39	0.3
30	M	0:42	6.0	1:23	<b>-0.6</b>
31	T	1:27	5.8	2:03	<b>-1.1</b>

June 2011 Low Tides					
Date	A.M.	Feet	P.M.	Feet	
1	W	2:07	5.7	2:42	<b>-1.5</b>
2	T	2:45	5.6	3:19	<b>-1.7</b>
3	F	3:22	5.4	3:56	<b>-1.8</b>
4	S	4:00	5.3	4:33	<b>-1.8</b>
5	S	4:40	5.2	5:11	<b>-1.5</b>
6	M	5:23	5.0	5:52	<b>-1.1</b>
7	T	6:10	4.6	6:35	<b>-0.3</b>
8	W	7:03	4.2	7:23	0.9
9	T	8:05	3.4	8:20	2.4
10	F	9:19	2.1	9:27	3.7
11	S	10:32	0.5	10:36	4.5
12	S	11:44	-0.9	11:46	4.9
13	M	---	---	12:50	<b>-2.2</b>
14	T	0:54	4.9	1:46	<b>-3.1</b>
15	W	1:52	4.5	2:35	<b>-3.4</b>
16	T	2:41	4.1	3:20	<b>-3.2</b>
17	F	3:26	3.9	4:00	<b>-2.5</b>
18	S	4:08	4.0	4:36	<b>-1.6</b>
19	S	4:48	4.3	5:09	<b>-0.6</b>
20	M	5:26	4.7	5:42	0.4
21	T	6:05	4.9	6:17	1.7
22	W	6:46	5.0	6:57	3.4
23	T	7:36	4.9	7:44	5.4
24	F	8:41	4.5	8:48	7.4
25	S	9:53	3.5	10:06	8.3
26	S	10:59	2.2	11:13	8.2
27	M	11:59	0.9	---	---
28	T	0:10	7.7	12:52	<b>-0.1</b>
29	W	0:59	7.0	1:39	<b>-0.9</b>
30	T	1:43	6.3	2:21	<b>-1.6</b>

July 2011 Low Tides					
Date	A.M.	Feet	P.M.	Feet	
1	F	2:25	5.5	3:01	<b>-2.2</b>
2	S	3:06	4.7	3:40	<b>-2.6</b>
3	S	3:48	3.9	4:17	<b>-2.7</b>
4	M	4:30	3.1	4:55	<b>-2.6</b>
5	T	5:14	2.4	5:34	<b>-2.1</b>
6	W	6:00	1.7	6:14	<b>-1.0</b>
7	T	6:49	1.2	6:59	0.8
8	F	7:46	0.9	7:51	3.1
9	S	8:53	0.7	8:59	5.3
10	S	10:07	0.3	10:15	6.5
11	M	11:28	-0.4	11:33	6.7
12	T	---	---	12:39	<b>-1.5</b>
13	W	0:47	5.9	1:35	<b>-2.5</b>
14	T	1:43	4.9	2:23	<b>-2.8</b>
15	F	2:30	4.0	3:04	<b>-2.5</b>
16	S	3:12	3.5	3:40	<b>-1.9</b>
17	S	3:51	3.3	4:12	<b>-1.1</b>
18	M	4:27	3.2	4:42	<b>-0.3</b>
19	T	5:01	3.1	5:12	0.5
20	W	5:35	3.0	5:44	1.7
21	T	6:11	2.7	6:18	3.4
22	F	6:52	2.7	6:57	5.6
23	S	7:41	3.0	7:44	8.1
24	S	8:45	3.4	9:02	10.2
25	M	10:05	3.1	10:38	10.1
26	T	11:18	2.1	11:40	9.0
27	W	---	---	12:21	0.9
28	T	0:32	7.6	1:13	<b>-0.4</b>
29	F	1:20	6.1	1:57	<b>-1.6</b>
30	S	2:05	4.5	2:39	<b>-2.5</b>
31	S	2:50	2.9	3:18	<b>-3.1</b>

August 2011 Low Tides					
Date	A.M.	Feet	P.M.	Feet	
1	M	3:34	1.5	3:57	<b>-3.3</b>
2	T	4:17	0.3	4:35	<b>-3.0</b>
3	W	5:01	<b>-0.6</b>	5:14	<b>-2.1</b>
4	T	5:45	<b>-1.1</b>	5:53	<b>-0.5</b>
5	F	6:32	<b>-1.1</b>	6:36	1.7
6	S	7:24	<b>-0.4</b>	7:27	4.6
7	S	8:27	0.5	8:39	7.2
8	M	9:44	1.2	10:06	8.1
9	T	11:15	0.8	11:32	7.3
10	W	---	---	12:27	<b>-0.6</b>
11	T	0:40	5.5	1:20	<b>-1.7</b>
12	F	1:31	4.0	2:04	<b>-2.0</b>
13	S	2:15	3.0	2:42	<b>-1.5</b>
14	S	2:55	2.4	3:15	<b>-0.8</b>
15	M	3:31	2.2	3:44	<b>-0.1</b>
16	T	4:03	1.9	4:12	0.6
17	W	4:34	1.6	4:41	1.3
18	T	5:06	1.3	5:12	2.5
19	F	5:40	1.0	5:43	4.1
20	S	6:19	1.2	6:18	6.2
21	S	7:02	2.0	7:01	8.6
22	M	7:54	3.1	7:57	10.8
23	T	9:03	4.0	9:50	11.5
24	W	10:32	3.5	11:08	9.6
25	T	11:43	2.1	---	---
26	F	0:03	7.4	12:39	0.4
27	S	0:54	5.0	1:27	<b>-1.0</b>
28	S	1:43	2.8	2:11	<b>-2.1</b>
29	M	2:30	0.7	2:53	<b>-2.7</b>
30	T	3:16	<b>-1.0</b>	3:33	<b>-2.7</b>
31	W	4:00	<b>-2.3</b>	4:13	<b>-2.1</b>

September 2011 Low Tides					
Date	A.M.	Feet	P.M.	Feet	
1	T	4:44	<b>-3.0</b>	4:52	<b>-0.9</b>
2	F	5:27	<b>-3.0</b>	5:33	1.0
3	S	6:13	<b>-2.1</b>	6:16	3.4
4	S	7:02	<b>-0.6</b>	7:08	6.3
5	M	8:02	1.3	8:28	8.6
6	T	9:21	2.6	10:02	8.5
7	W	10:55	2.3	11:24	6.7
8	T	---	---	12:05	1.0
9	F	0:25	4.4	15:56	<b>-0.0</b>
10	S	1:14	2.7	1:38	<b>-0.2</b>
11	S	1:56	1.7	2:14	0.2
12	M	2:33	1.2	2:45	0.9
13	T	3:07	1.0	3:14	1.5
14	W	3:37	0.7	3:42	2.1
15	T	4:07	0.4	4:12	2.8
16	F	4:39	0.2	4:42	3.9
17	S	5:13	0.2	5:14	5.3
18	S	5:50	0.6	5:48	7.0
19	M	6:31	1.6	6:31	8.9
20	T	7:19	3.0	7:26	10.6
21	W	8:17	4.2	8:41	11.2
22	T	9:38	4.4	10:29	9.4
23	F	10:56	3.2	11:32	6.4
24	S	11:58	1.5	---	---
25	S	0:28	3.5	12:51	0.1
26	M	1:20	0.8	1:39	<b>-0.8</b>
27	T	2:10	<b>-1.4</b>	2:25	<b>-1.2</b>
28	W	2:57	<b>-3.1</b>	3:08	<b>-1.0</b>
29	T	3:42	<b>-4.1</b>	3:51	<b>-0.3</b>
30	F	4:26	<b>-4.2</b>	4:33	1.0

October 2011 Low Tides					
Date	A.M.	Feet	P.M.	Feet	
1	S	5:09	<b>-3.6</b>	5:15	2.7
2	S	5:53	<b>-2.2</b>	6:00	5.0
3	M	6:40	<b>-0.2</b>	6:56	7.3
4	T	7:36	2.1	8:16	8.8
5	W	8:49	3.8	9:45	8.1
6	T	10:15	4.1	11:02	6.0
7	F	11:31	3.4	---	---
8	S	0:01	3.6	12:23	2.6
9	S	0:49	1.8	1:05	2.4
10	M	1:30	0.7	1:41	2.6
11	T	2:07	0.2	2:12	2.9
12	W	2:41	<b>-0.0</b>	2:43	3.3
13	T	3:12	<b>-0.2</b>	3:15	3.8
14	F	3:43	<b>-0.4</b>	3:46	4.4
15	S	4:15	<b>-0.4</b>	4:18	5.3
16	S	4:49	<b>-0.2</b>	4:50	6.3
17	M	5:26	0.4	5:27	7.4
18	T	6:06	1.4	6:11	8.6
19	W	6:51	2.6	7:05	9.5
20	T	7:45	3.7	8:11	9.6
21	F	8:51	4.3	9:43	7.9
22	S	10:06	3.7	10:58	4.9
23	S	11:12	2.7	---	---
24	M	0:00	1.8	12:11	1.7
25	T	0:56	<b>-0.8</b>	1:07	1.2
26	W	1:49	<b>-2.8</b>	1:58	1.0
27	T	2:38	<b>-4.1</b>	2:46	1.1
28	F	3:24	<b>-4.7</b>	3:31	1.7
29	S	4:09	<b>-4.4</b>	4:16	2.6
30	S	4:52	<b>-3.4</b>	5:01	3.9
31	M	5:35	<b>-1.9</b>	5:48	5.5

\*To catch a bore tide at: Beluga Point, add 1:15 and for Bird Point, add 2:15 to the low tide times.

\*A low tide of -3.0 or greater will produce a strong bore tide.