How to Use This Book

Confused about the location of any secondary station? Visit our Directory of Secondary Stations at **portsandpasses.com**

Visit **portsandpasses.com/quick-guide** to view and download the Quick Guide PDF version.

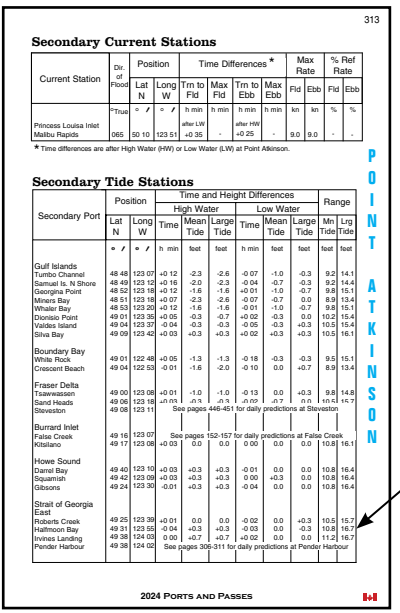
Visit **portsandpasses.com** to view a video version of this guide
https://www.youtube.com/@portsandpasses7669

Tides

1. Wherever you are on the west coast, there is a tide station near you (known as a reference station) for which tide predictions are tabulated. Using one of the overview charts on pages x, xii, or xiv, identify the coloured area that includes your location.

2. Each coloured area is associated with a particular reference station. Turn to the page of that reference station. In this case, you are in Halfmoon Bay in the yellow area, which is associated with the reference station **POINT ATKINSON**.

3. In the secondary station tables associated with the reference station, find the location closest to your location.



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Secondary Current Stations

Current Station	Dir. of Flood	Position Lat N	Position Long W	Time Differences * Trn to Fld	Time Differences * Max Fld	Time Differences * Trn to Ebb	Time Differences * Max Ebb	Max Rate Fld	Max Rate Ebb	% Ref Rate Fld	% Ref Rate Ebb
	°True	° ′	° ′	h min	h min	h min	h min	kn	kn	%	%
				after LW		after HW					
Princess Louisa Inlet											
Malibu Rapids	065	50 10	123 51	+2.35	-	+0.25	-	9.0	9.0	-	-

* Time differences are after High Water (HW) or Low Water (LW) at Point Atkinson.

Secondary Tide Stations

Secondary Port	Position Lat N	Position Long W	Time and Height Differences High Water Time	High Water Mean Tide	High Water Large Tide	Low Water Time	Low Water Mean Tide	Low Water Large Tide	Range Mn Tide	Range Lrg Tide
	° ′	° ′	h min	feet	feet	h min	feet	feet	feet	feet
Gulf Islands										
Tumbo Channel	48 48	123 07	+0 12	-2.3	-2.6	-0 07	-1.0	-0.3	9.2	14.1
Samuel Is. N Shore	48 49	123 12	+0 16	-2.0	-2.3	-0 04	-0.7	-0.3	9.2	14.4
Georgina Point	48 52	123 18	+0 12	-1.6	-1.6	+0 01	-1.0	-0.7	9.8	15.1
Miners Bay	48 51	123 18	+0 07	-2.3	-2.6	-0 07	-0.7	0.0	8.9	13.4
Whaler Bay	48 53	123 20	+0 12	-1.6	-1.6	-0 01	-1.0	-0.7	9.8	15.1
Dionisio Point	49 01	123 35	+0 05	-0.3	-0.7	+0 02	-0.3	0.0	10.2	15.4
Valdes Island	49 04	123 37	-0 04	-0.3	-0.3	-0 05	-0.3	+0.3	10.5	15.4
Silva Bay	49 09	123 42	+0 03	-0.3	+0.3	+0 02	+0.3	+0.3	10.5	16.1
Boundary Bay										
White Rock	49 01	122 48	+0 05	-1.3	-1.3	-0 18	-0.3	-0.3	9.5	15.1
Crescent Beach	49 04	122 53	-0 01	-1.6	-2.0	-0 10	0.0	+0.7	8.9	13.4
Fraser Delta										
Tsawwassen	49 00	123 08	+0 01	-1.0	-1.0	-0 13	0.0	+0.3	9.8	14.8
Sand Heads	49 06	123 18	+0 03	-0.3	-0.3	-0 00	-0.7	0.0	10.5	15.7
Steveston	49 08	123 11	See pages 446-451 for daily predictions at Steveston							
Burrard Inlet										
False Creek	49 16	123 07	See pages 152-157 for daily predictions at False Creek							
Kitsilano	49 17	123 08	+0 03	0.0	0.0	0 00	0.0	0.0	10.8	16.1
Howe Sound										
Darrel Bay	49 40	123 10	+0 03	-0.3	-0.3	-0 01	0.0	0.0	10.8	16.4
Squamish	49 42	123 09	+0 03	-0.3	-0.3	0 00	+0.3	0.0	10.8	16.4
Gibsons	49 24	123 30	-0 01	+0.3	+0.3	-0 04	0.0	0.0	10.8	16.4
Strait of Georgia East										
Roberts Creek	49 25	123 39	+0 01	0.0	0.0	-0 02	0.0	+0.3	10.5	15.7
Halfmoon Bay	49 31	123 55	-0 04	+0.3	+0.3	-0 03	0.0	-0.3	10.8	16.7
Irvines Landing	49 38	124 03	0 00	+0.7	+0.7	+0 02	0.0	0.0	11.2	16.7
Pender Harbour	49 38	124 02	See pages 306-311 for daily predictions at Pender Harbour							

POINT ATKINSON

2024 Ports and Passes

4. In the row for that secondary location, you will find corrections for the height and the time of high or low water. Add (or subtract) these corrections from the height or times of the predicted tides at the reference station (**POINT ATKINSON**) for the day in question.

5. The result will be the height or time of the tide at the secondary location on that day.

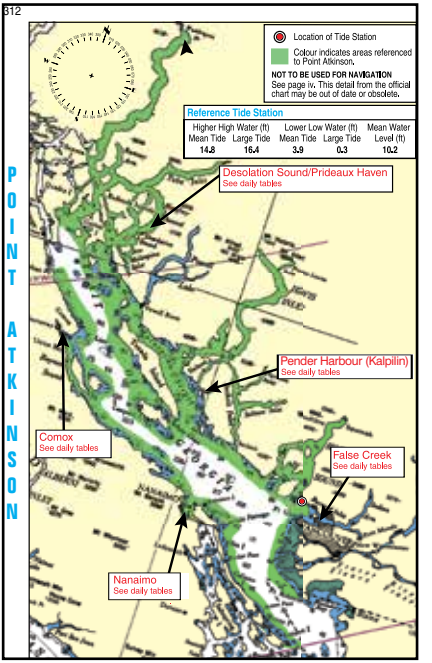
NOTE: ALWAYS CHECK FOR ERRATA

When using Ports and Passes, be sure to check our website for any applicable errata notations.

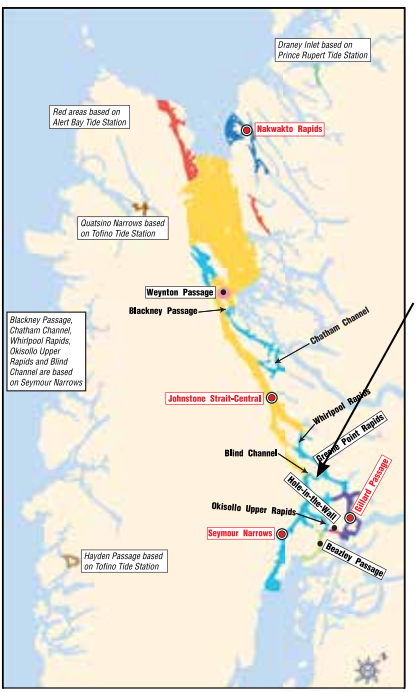
www.portsandpasses.com

6. Refer to page xviii for procedures and worksheets to use for correcting tide predictions in both Canada and the US. For more copies of the worksheets, visit **portsandpasses.com**

7. **Ports and Passes** has provided predictions for some non-reference locations within the coloured areas (e.g. Nanaimo, Pender Harbour, False Creek). If you are in one of those non-reference locations (such as Nanaimo), you can go directly to the pages for that location. These non-reference locations are clearly identified on the map and in the secondary tables associated with the reference station for the area.



Currents



1. In the United States, all tidal areas are associated with a reference current station for which current predictions are tabulated. In Canada, this is not always the case. Using one of the overview charts on pages ix, xi, xiii, or xv identify the coloured area that includes your location.

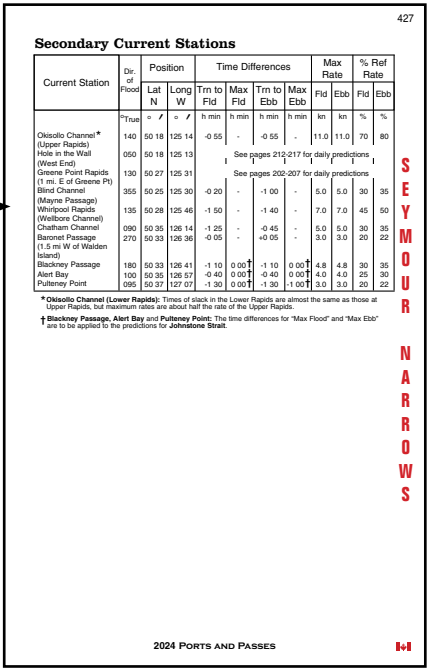
2. Each coloured area is associated with a particular reference current station. Turn to the page of that reference current station. In this case, you are in Mayne Passage (in the blue area), which is associated with the reference current station **SEYMOUR NARROWS**.

3. In the secondary station tables associated with the reference station, find the location closest to your location.

4. In the line for that secondary location, you will find corrections for the time of slack [Turn to Ebb (TTE) or Turn to Flood (TTF)] and the time and speed of the maximum current. Add (or subtract) these corrections from the times of the predicted slack or maximum current at the reference station (**SEYMOUR NARROWS**) for the day in question.

5. The result will be the time of slack and the time and speed of maximum current at the secondary location (Mayne Passage) on that day.

6. Refer to page xx for worksheets to use for correcting current predictions in both Canada and the US. For more copies of the worksheets, visit **portsandpasses.com**.



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Secondary Current Stations

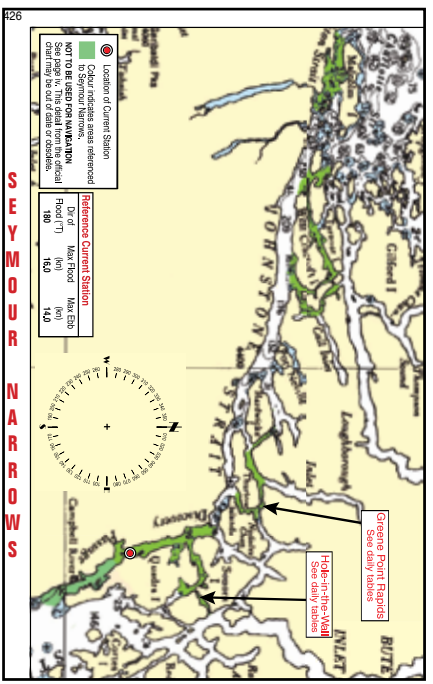
Current Station	Dir. of Flood	Position Lat N	Position Long W	Time Differences: Trn to Fld	Max Fld	Trn to Ebb	Max Ebb	Max Rate Fld	Max Rate Ebb	% Ref Rate Fld	% Ref Rate Ebb
	°True	° ′	° ′	h min	h min	h min	h min	kn	kn	%	%
Okisollo Channel* (Upper Rapids)	140	50 18	125 14	-0 55	-	-0 55	-	11.0	11.0	70	80
Hole in the Wall (West End)	050	50 18	125 13	See pages 212-217 for daily predictions							
Greene Point Rapids (1 mi. E of Greene Pt)	130	50 27	125 31	See pages 202-207 for daily predictions							
Blind Channel (Mayne Passage)	355	50 25	125 30	-0 20	-	-1 00	-	5.0	5.0	30	35
Whirlpool Rapids (Wellbore Channel)	135	50 28	125 46	-1 50	-	-1 40	-	7.0	7.0	45	50
Chatham Channel	090	50 35	126 14	-1 25	-	-0 45	-	5.0	5.0	30	35
Baronet Passage (1.5 mi W of Walden Island)	270	50 33	126 36	-0 05	-	+0 05	-	3.0	3.0	20	22
Blackney Passage	180	50 33	126 41	-1 10	0 00†	-1 10	0 00†	4.8	4.8	30	35
Alert Bay	100	50 35	126 57	-0 40	0 00†	-0 40	0 00†	4.0	4.0	25	30
Pulteney Point	095	50 37	127 07	-1 30	0 00†	-1 30	-1 00†	3.0	3.0	20	22

* **Okisollo Channel (Lower Rapids):** Times of slack in the Lower Rapids are almost the same as those at Upper Rapids, but maximum rates are about half the rate of the Upper Rapids.

† **Blackney Passage, Alert Bay** and **Pulteney Point:** The time differences for "Max Flood" and "Max Ebb" are to be applied to the predictions for **Johnstone Strait**.

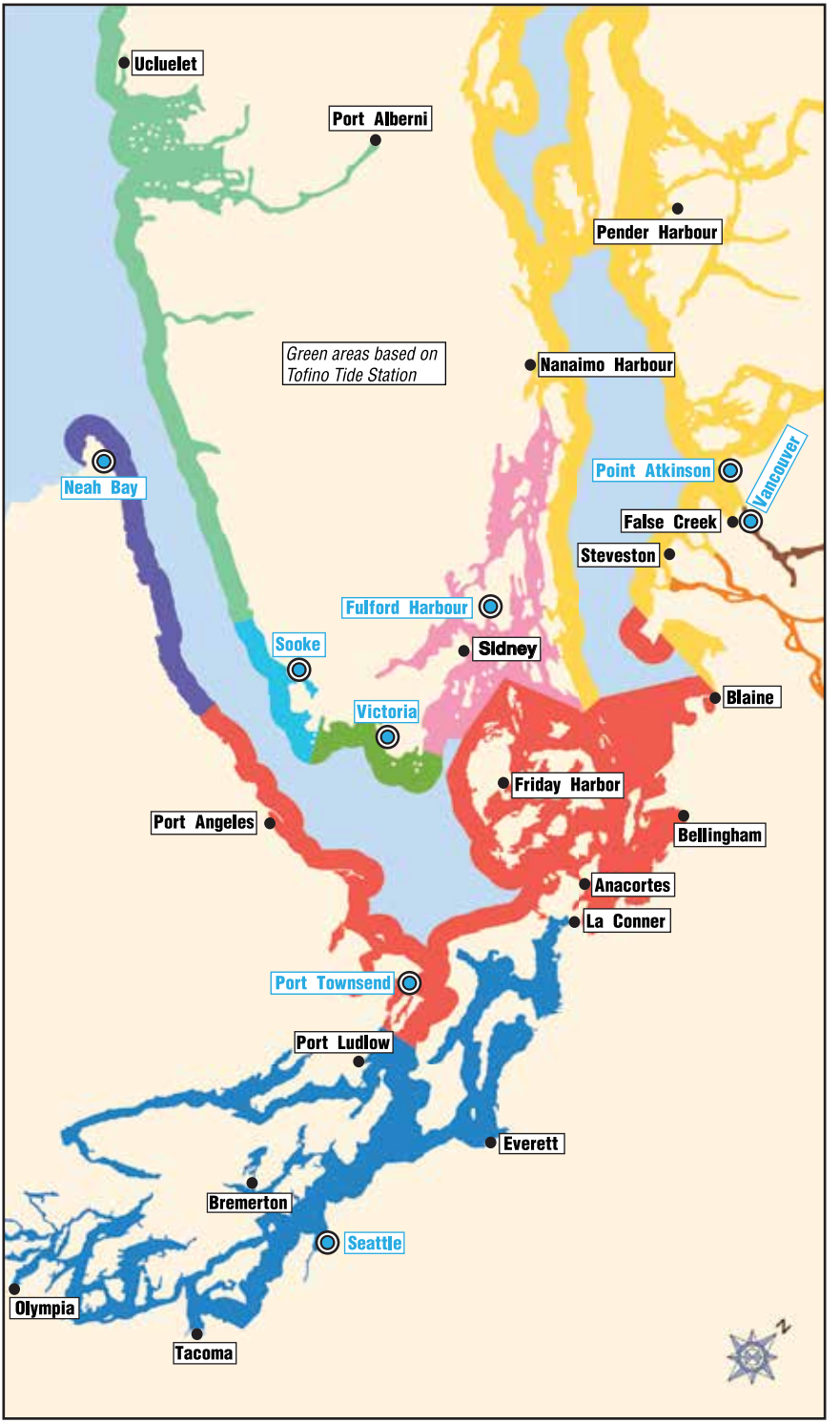
SEYMOUR NARROWS

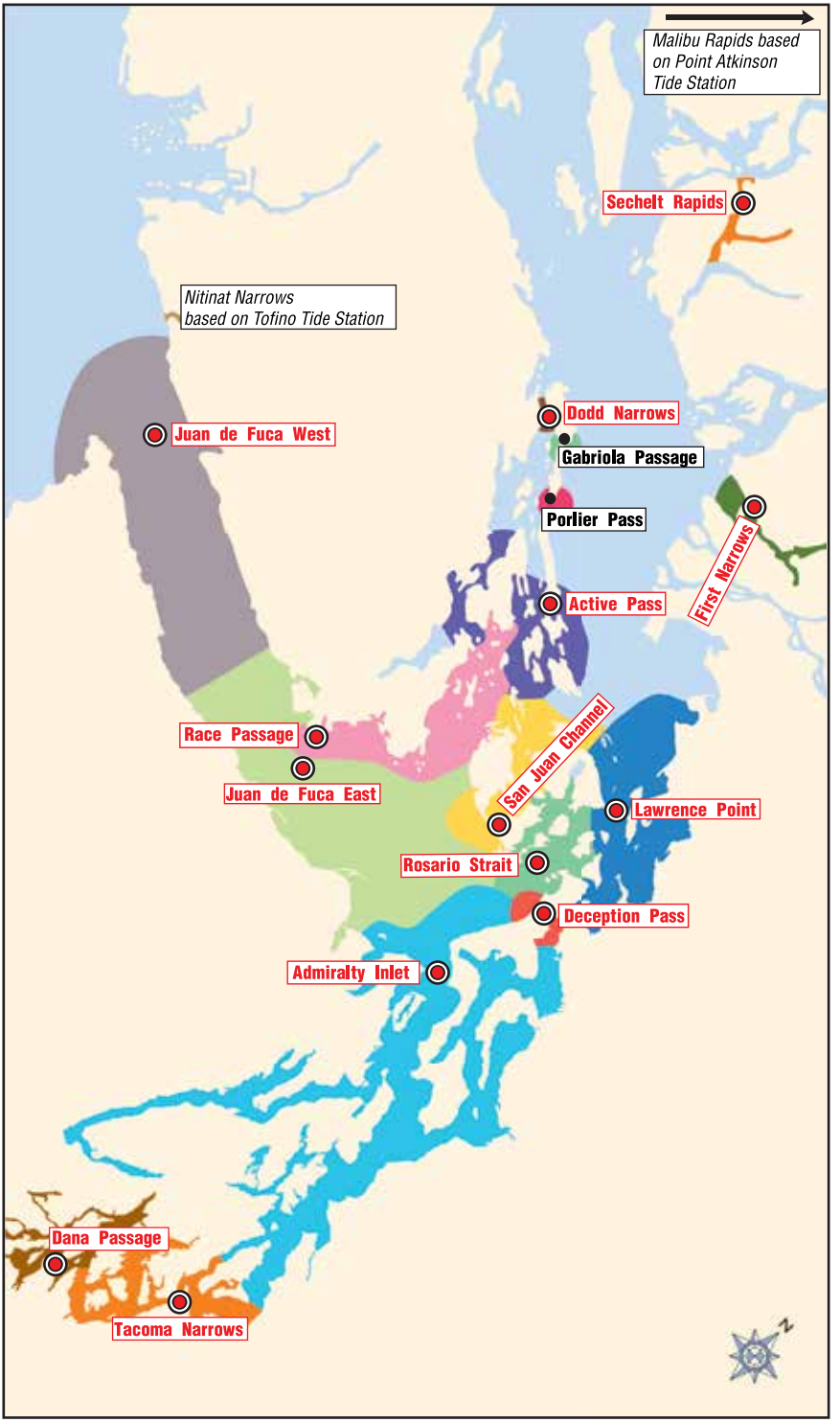
2024 PORTS AND PASSES



7. **PORTS AND PASSES** has provided predictions for some non-reference locations within the coloured areas (e.g. Porlier Passage, Greene Point Rapids, Hole-in-the-Wall). If you are in one of those non-reference locations (such as Greene Point Rapids), you can go directly to the pages for that location. These non-reference locations are clearly identified on the overview map.

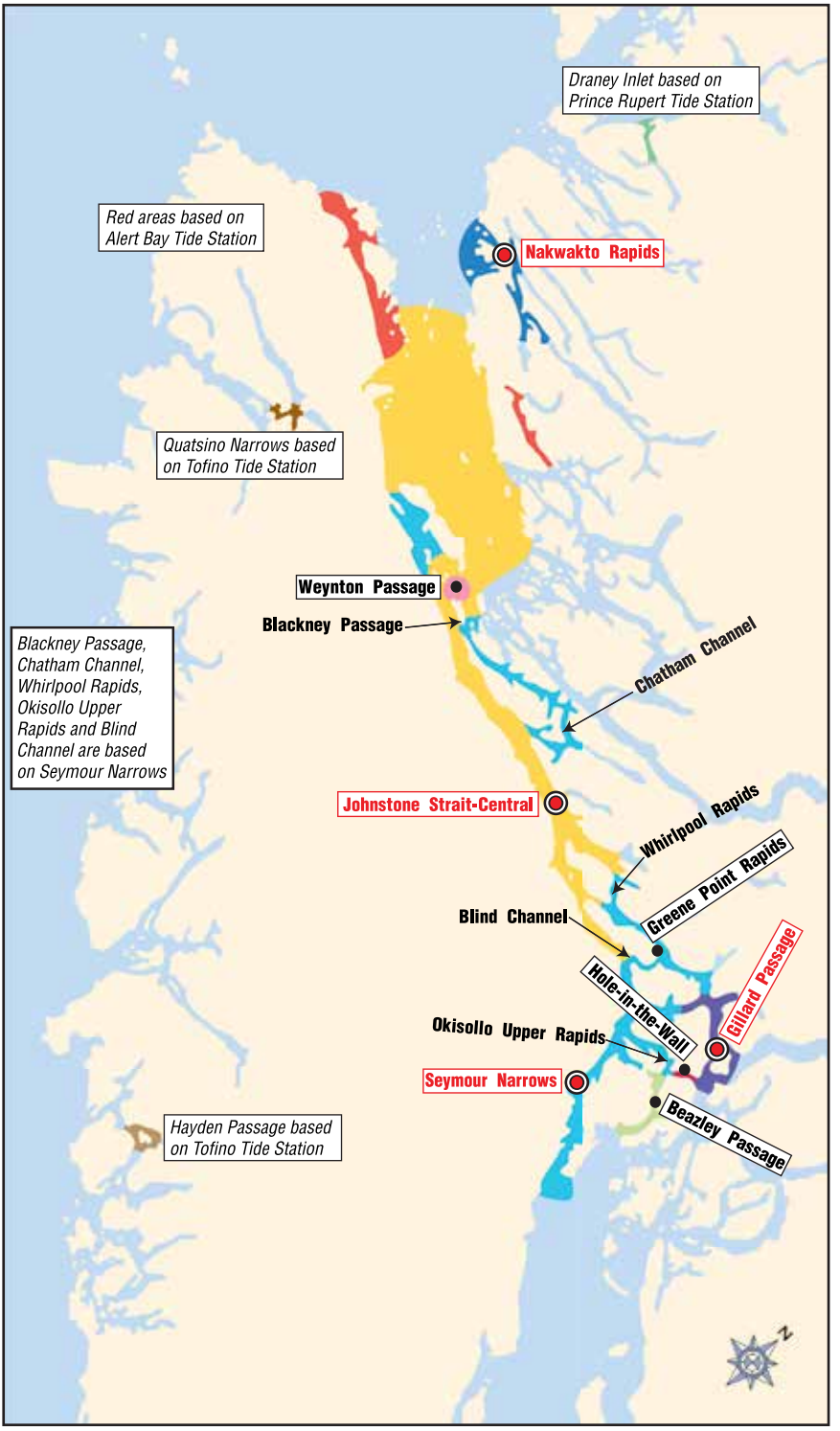
8. To find the times of TTE and TTF for certain secondary current locations, you must apply a correction to the times of high or low water at a reference tide station such as **TOFINO** or **PRINCE RUPERT**. Refer to page xviii for worksheets for finding the times of TTF or TTE by applying corrections to a reference tide station.

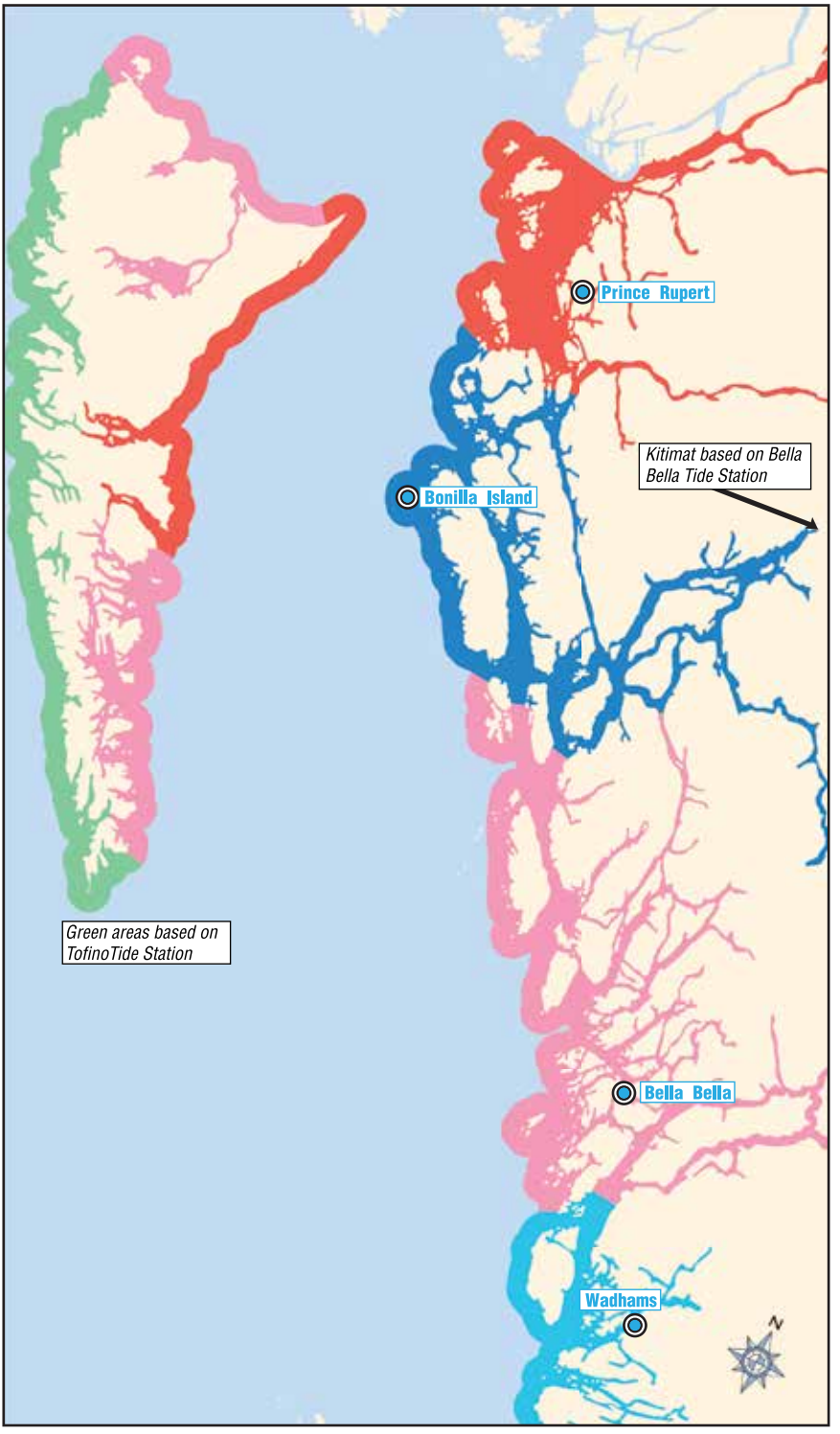

Ucluelet
Port Alberni
Pender Harbour
Green areas based on Tofino Tide Station
Nanaimo Harbour
Neah Bay
Point Atkinson
Vancouver
False Creek
Steveston
Fulford Harbour
Sooke
Sidney
Victoria
Blaine
Friday Harbor
Port Angeles
Bellingham
Anacortes
La Conner
Port Townsend
Port Ludlow
Everett
Bremerton
Seattle
Olympia
Tacoma

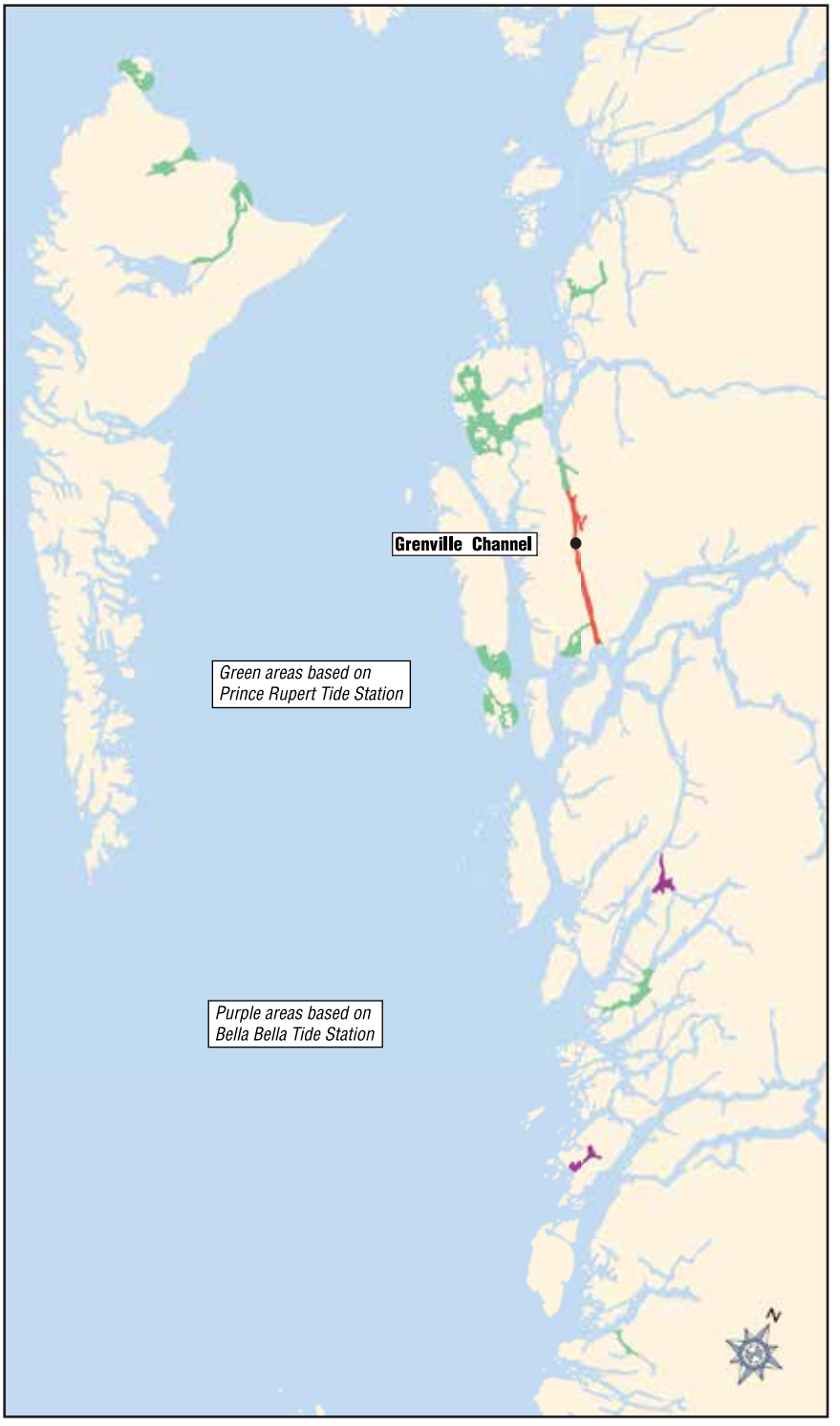

Malibu Rapids based on Point Atkinson Tide Station
Sechelt Rapids
Nitinat Narrows based on Tofino Tide Station
Juan de Fuca West
Dodd Narrows
Gabriola Passage
Porlier Pass
First Narrows
Active Pass
Race Passage
Juan de Fuca East
San Juan Channel
Lawrence Point
Rosario Strait
Deception Pass
Admiralty Inlet
Dana Passage
Tacoma Narrows

OVERVIEW CHART 2 TIDES

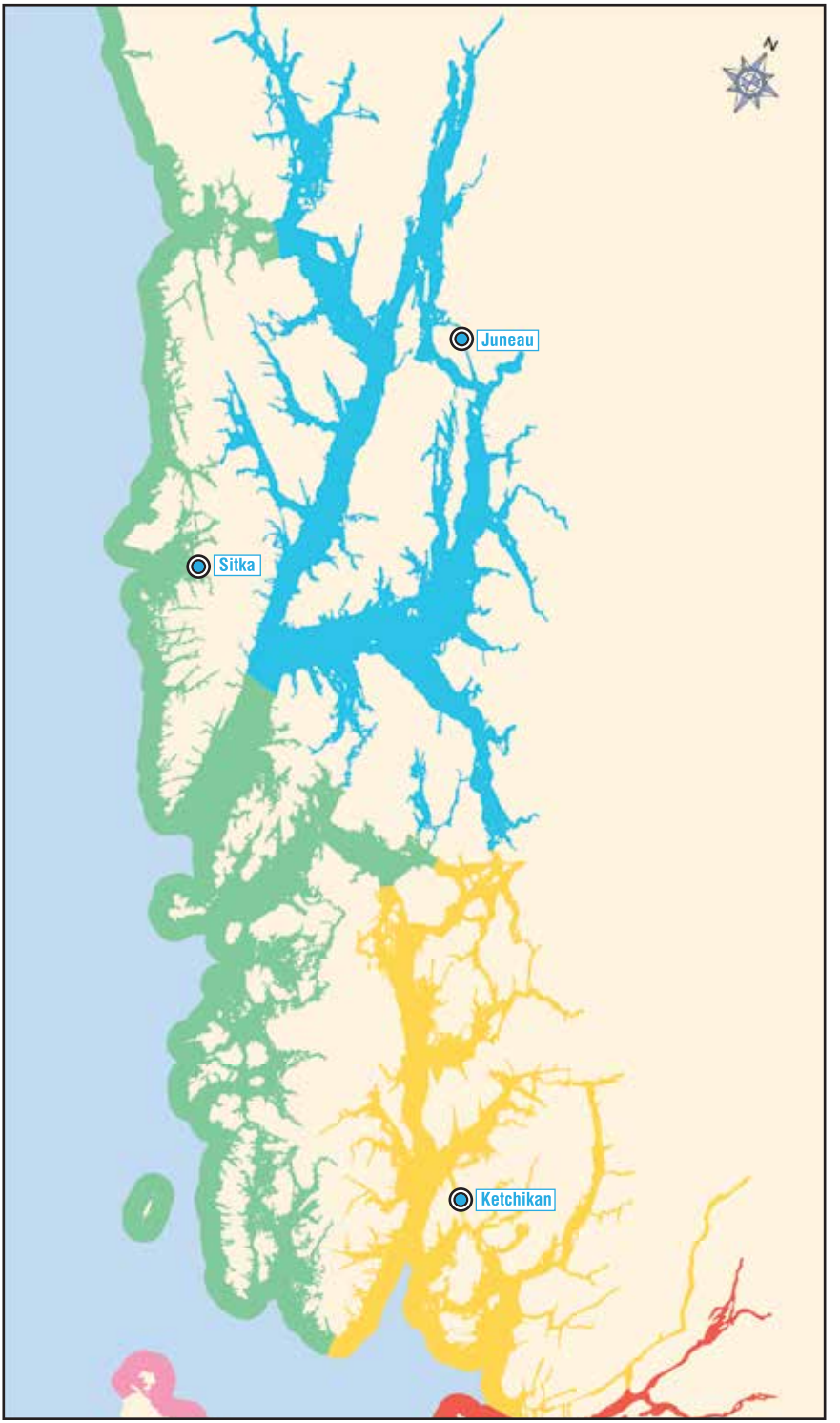


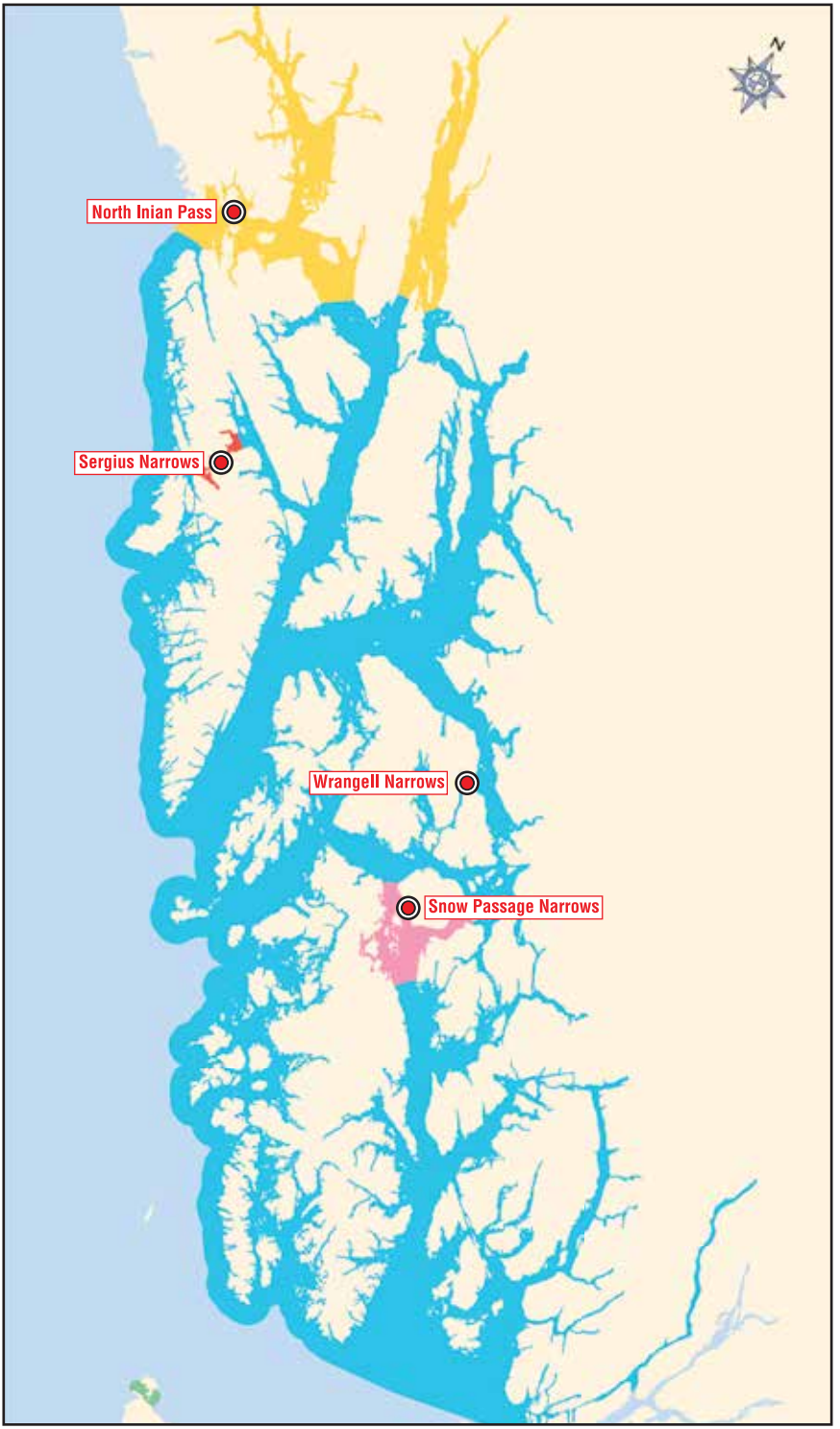

Draney Inlet based on Prince Rupert Tide Station
Red areas based on Alert Bay Tide Station
Nakwakto Rapids
Quatsino Narrows based on Tofino Tide Station
Weynton Passage
Blackney Passage
Blackney Passage, Chatham Channel, Whirlpool Rapids, Okisollo Upper Rapids and Blind Channel are based on Seymour Narrows
Chatham Channel
Johnstone Strait-Central
Whirlpool Rapids
Greene Point Rapids
Blind Channel
Hole-in-the-Wall
Gillard Passage
Okisollo Upper Rapids
Seymour Narrows
Beazley Passage
Hayden Passage based on Tofino Tide Station
N


Prince Rupert
Kitimat based on Bella Bella Tide Station
Bonilla Island
Green areas based on TofinoTide Station
Bella Bella
Wadhams
N


Grenville Channel
Green areas based on
Prince Rupert Tide Station
Purple areas based on
Bella Bella Tide Station
N

OVERVIEW CHART 4 TIDES




North Inian Pass
Sergius Narrows
Wrangell Narrows
Snow Passage Narrows

How to Read the Tables

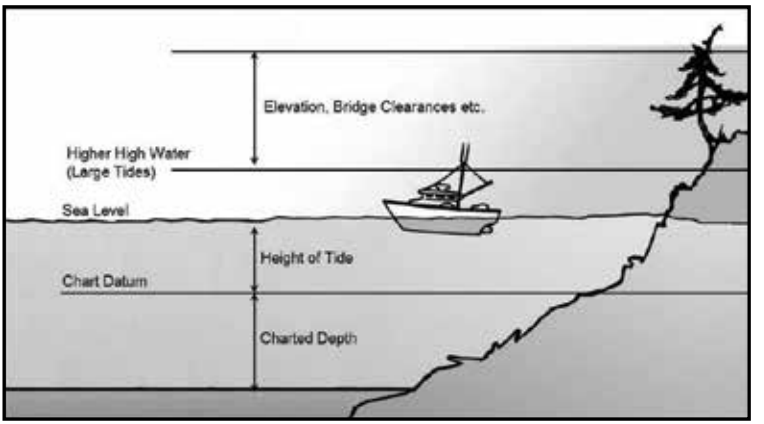
Reading Tide Tables

Since the level of the sea surface rises and falls on a regular basis, hydrographers have established a reference plane by which all tidal heights can be measured. This reference plane is the chart (or tidal) datum and is represented on charts as the zero tide level. Depths are measured below the chart datum; the height of tides and intertidal objects, such as rocks and shoals, are measured above it.

May

DAY	TIME	FT	M
1	4:31a	15.7	4.8
	11:52a	1.6	0.5
Sat	6:20p	12.8	3.9
	11:24p	7.5	2.3

The height of tide is the vertical distance between the surface of the sea and chart datum. For example, at a place where the chart shows the depth to be 1m (3.3 ft.) and the predicted low water is 0.6m (2.1 ft.) above chart datum, the actual depth at Low Water would be 1.6m (5.4 ft.).



Reading Current Tables

The shaded column (titled SLK) gives the time of slack current (the time the current turns from ebb to flood or vice versa). At this time, the speed of the current is minimal and there is usually no horizontal movement of surface water. The next column (MAX) displays the time at which the maximum flood or ebb can be expected. The F/E column gives the speed of the current in knots and is labelled either positive (flood) or negative (ebb).

June

DAY	*SLK*	*MAX*	*F/E*
1		1:47a	-4.0
	5:41a	7:42a	+1.3
Mon	9:46a	1:17p	-3.0
	4:18p	7:54p	+4.2
	11:22p		

DAY	SLK	MAX	F/E
8		12:29a	+1.1
Tue	3:16a	6:36a	-1.6
	11:55a	6:34p	1.0
	10:45p		

Juan De Fuca East

DAY	SLK	MAX	F/E
1	-	4:23a	-2.5
Wed	8:37a	11:27a	+1.4
	4:17p	7:11p	-0.5
	***	5:35a	-2.5

Rosario Strait

Special Codes in Current Tables

There are rare occasions when the period of slack or "weak and variable" currents extends for up to two and one-half hours. In those cases, **Ports and Passes** assigns the time of slack to the beginning of the period of slack or "weak and variable" current and identifies such an occasion with a black border (see Juan de Fuca East, April 8).

Where the time is indicated by asterisks (***), this indicates that the time of slack (or maximum flow) is indeterminate (see Rosario Strait, October 1).

Calculating Tides and Currents

Reference and Secondary Stations

A reference tide or current station is a location at which the tide or current data has been studied over a significant length of time. These are the stations for which daily tables are published by national hydrographic agencies.

Secondary tide and secondary current stations have been studied for a much shorter period of time than the reference stations, sometimes for as little as one month.

Daily predictions for secondary stations are normally available only online. However, to provide values for the secondary stations, **Ports and Passes** publishes tables of corrections which are to be applied to the times and heights of high or low water or the time and speed of currents. A table of corrections for secondary stations accompanies each reference station.

Though a secondary station may have similar characteristics to the reference station, no two stations in the world are identical and the predictions made by applying the corrections can never be considered as accurate as the full predictions for a reference port. However, if applied properly, the corrections found in the secondary tables will provide reasonably accurate approximations for all navigational purposes.

For the reader's convenience, **Ports and Passes** also includes daily predictions for some of the most popular secondary stations (identified in the Table of Contents by non-bolded text). These predictions are based on the actual hydrographic data, not by application of the corrections in the secondary tables.

For your convenience, a series of worksheets is provided to assist in applying the secondary corrections.

Instructions and worksheets are available on the **Ports and Passes** website (portsandpasses.com) and Waggoner Guide website (waggonerguide.com).

Note: If the time difference is positive, the high or low water, or the turn of the current, occurs at the secondary station later than the reference station. If the time difference is negative, the reverse is true.

Notes for Worksheet 3 (Secondary Current Calculations)

A column for the time of maximum current is not provided. This is normally not of interest to mariners and, when calculated from secondary corrections, not very reliable. The time of slack and the strength of the current are usually of much greater concern.

Also, some secondary current stations are referenced to a tide station (for example, Malibu Rapids is referenced to Point Atkinson). Normally, it is not possible to calculate the Speed at Max for these stations.

Secondary Tide Calculations

In the Secondary Tides Calculations, two different methods are used. If a height difference is given (all Canadian and some US locations), use **Worksheet 1**. If a height ratio is given (some US locations), use **Worksheet 2**.

Worksheet 1

Secondary Tides Calculations (Height difference) (Canada & US)

Reference Station: _____ **Date:** _____

Secondary Station: _____

	Reference Station		Corrections		Secondary Station	
	Time hr min *Column 1*	Height ft / metres *Column 2*	Time difference hr min *Column 3*	Height difference* ft / metres *Column 4*	Time hr min *Column 5*	Height ft / metres *Column 6*
LW			+ -	+ -	=	=
HW			+ -	+ -	=	=
LW			+ -	+ -	=	=
HW			+ -	+ -	=	=
LW			+ -	+ -	=	=

* *(Canada Only) You should normally use the correction for "Mean Tide". Use the "Large Tide" differences only when the tidal range between LW and HW is very large (during spring tides).*

Worked Example

Worksheet 1

Secondary Tides Calculations (Height difference) (Canada & US)

Reference Station: POINT ATKINSON **Date:** JUNE 6 2024

Secondary Station: LUND

	Reference Station		Corrections		Secondary Station	
	Time hr min *Column 1*	Height ft / ~~metres~~ *Column 2*	Time difference hr min *Column 3*	Height difference* ft / ~~metres~~ *Column 4*	Time hr min *Column 5*	Height ft / ~~metres~~ *Column 6*
LW			+ -	+ -	=	=
HW	12:15 AM	11.5	+ 0:07 -	+ 1.3 -	= 12:22 AM	= 12.8
LW	7:20 AM	-0.3	+ 0:09 -	+ 0.0 -	= 7:29 AM	= -0.3
HW	1:49 PM	9.9	+ 0:07 -	+ 1.3 -	= 1:56 PM	= 10.2
LW	6:56 PM	4.3	+ 0:09 -	+ 0.3 -	= 7:05 PM	= 4.6

- Large Tide

Secondary Tide Calculations

Worksheet 2

Secondary Tides Calculation (Height ratio) (US)

Reference Station: _____ **Date:** _____

Secondary Station: _____

	Reference Station		Corrections		Secondary Station	
	Time hr min *Column 1*	Height ft / metres *Column 2*	Time difference hr min *Column 3*	Height ratio *Column 4*	Time hr min *Column 5*	Height ft / metres *Column 6*
LW			+ -	x	=	=
HW			+ -	x	=	=
LW			+ -	x	=	=
HW			+ -	x	=	=
LW			+ -	x	=	=

Worked Example

Worksheet 2

Secondary Tides Calculation (Height ratio) (US)

Reference Station: PORT TOWNSEND Date: JUNE 16, 2024

Secondary Station: POINT ROBERTS

	Reference Station		Corrections		Secondary Station	
	Time hr min *Column 1*	Height ft / ~~metres~~ *Column 2*	Time difference hr min *Column 3*	Height ratio *Column 4*	Time hr min *Column 5*	Height ft / ~~metres~~ *Column 6*
LW			+ -	x	=	=
HW	12:10 AM	8.1	+ 1:01 -	x 1.14	= 1:11 AM	= 9.2
LW	7:36 AM	1.6	+ 1:33 -	x 1.08	= 9:09 AM	= 1.7
HW	3:23 PM	5.5	+ 1:01 -	x 1.14	= 4:24 PM	= 6.3
LW	6:13 PM	5.0	+ 1:33 -	x 1.08	= 7:46 PM	= 5.4

Secondary Current Calculations

Worksheet 3

Secondary Current Calculation ("Speed ratio" is also called "% ref. rate") (Canada & US)

Reference Station: _____ **Date:** _____

Secondary Station: _____

	Reference Station		Corrections		Secondary Station	
	Time of Turn hr min *Column 1*	Speed at Max (knots) *Column 2*	Time difference hr min *Column 3*	Speed ratio (% ref rate) *Column 4*	Time of Turn hr min *Column 5*	Speed at Max (knots) *Column 6*
TTF			+ -	x	=	=
TTE			+ -	x	=	=
TTF			+ -	x	=	=
TTE			+ -	x	=	=
TTF			+ -	x	=	=

Worked Example

Worksheet 3

Secondary Current Calculation ("Speed ratio" is also called "% ref. rate") (Canada & US)

Reference Station: SEYMOUR NARROWS Date: JUNE 9, 2024

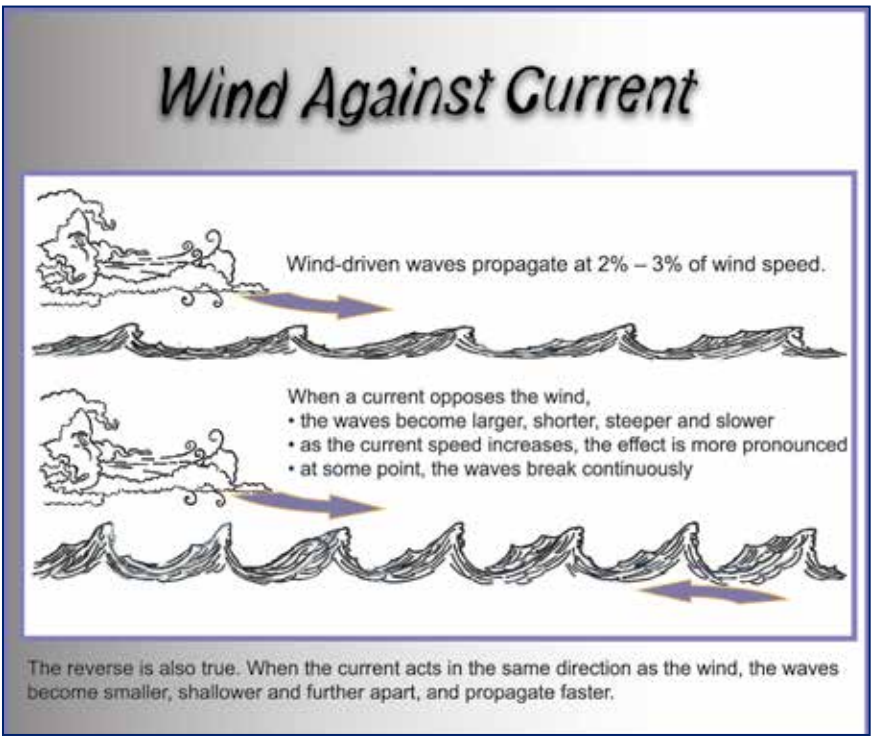
Secondary Station: WHIRLPOOL RAPIDS

	Reference Station		Corrections		Secondary Station	
	Time of Turn hr min *Column 1*	Speed at Max (knots) *Column 2*	Time difference hr min *Column 3*	Speed ratio (% ref rate) *Column 4*	Time of Turn hr min *Column 5*	Speed at Max (knots) *Column 6*
TTF	2:29AM	+5.9	+ -1:50	x 45%	= 12:39AM	= 2.7
TTE	7:27 AM	-9.9	+ -1:40	x 50%	= 5:47AM	= 5.0
TTF	1:47 PM	+12.7	+ -1:50	x 45%	= 11:57AM	= 5.7
TTE	8:51 PM	-10.4	+ -1:40	x 50%	= 7:11 PM	= 5.2
TTF			+ -	x	=	=

Wind Against Current

After the wind has blown for a while, the wind starts moving surface water in a downwind direction. In the same manner that the prevailing Trade Winds and temperate westerlies create the great ocean currents, local winds also act to retard or enhance a tidal current.

When a current opposes the wind, the waves become larger, shorter, steeper and slower. As the current speed (or the wind speed) increases, the effect is more pronounced.



When strong to gale force winds oppose the current, the waves may appear completely out of proportion to the conditions. At some point, the waves break continuously. Time your passages to avoid these conditions or use an alternate route.

In narrow channels, when current speed is equal but opposite to the speed of waves, standing waves are formed. Three to four knots of current in a narrow channel opposing a 40- to 50-knot wind will very likely generate standing waves.

Rule of Thumb—Wind Against Current

When the wind and the current are opposed, each knot of current has a similar effect on the waves as an additional 10 knots of wind.

When the wind and the current are acting in the same direction, each knot of current has a similar effect on the waves as a reduction of 10 knots of wind.

Observed Water Levels vs. Tidal Predictions

The Canadian Hydrographic Service (CHS) and the US National Oceanic and Atmospheric Adminstration (NOAA) collect water level observations, extract the constituent tidal constants and produce predictions for the future based on those constants. The prediction of tidal heights, however, is not an exact science and actual water levels may differ from predicted heights by a significant amount.

Changes in wind and barometric conditions cause variations in sea level from day to day. In general, onshore winds or low barometric pressure will raise the height of sea level, whereas offshore winds or high barometric pressure will cause the reverse. This effect may be exaggerated or diminished by the topography of the ocean surface. For instance, especially high tides may result from the combination of low barometric pressure combined with onshore winds blowing full strength along a long shallow bay or inlet.

Fresh water from rivers in flood or heavy rainfall may also cause a local increase in sea level but normally does not cause a significant increase in tidal heights anywhere else. However, the addition of a large volume of fresh water into the Strait of Georgia lying on top of the more saline waters of the Strait may cause a surface outflow current to develop in certain distant places such as Johnstone Strait and Queen Charlotte Strait. Wind and rainfall are both temporary and unpredicable events. Therefore, we can't account for them in the tide or current predictions for the coming year.

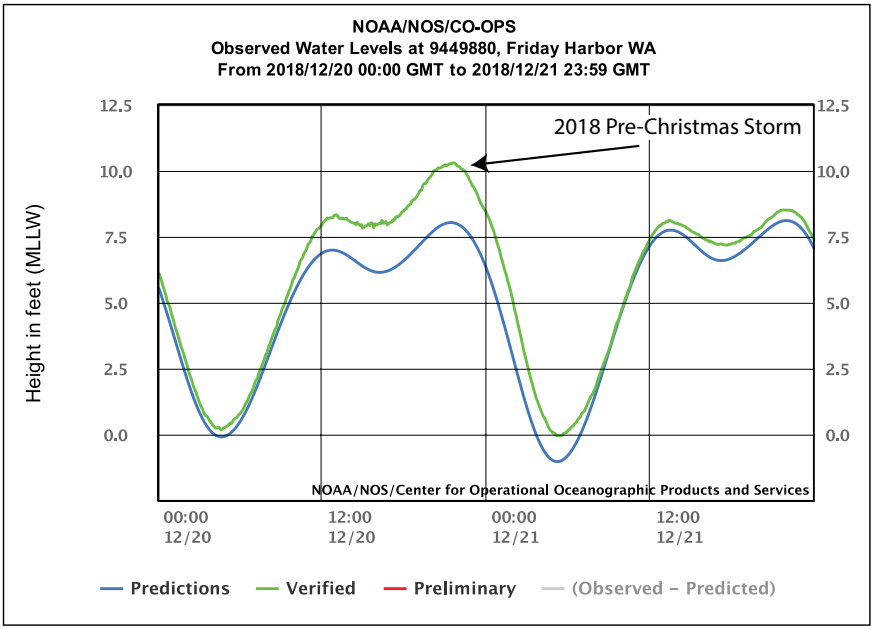
River levels vary on a seasonal basis. Typically, rivers which rise in the interior plateau are at peak flow during early summer because they are fed primarily by snowpack. Where possible, these variations are included in the tide tables because of the predictability. Notably, the tide tables for Steveston take into account the seasonal variations in the flow rate of the Fraser River. However, coastal rivers which rise in the Coast Mountains and the coastal plain tend to respond more to rainfall than snow-melt and, consequently, they reach peak flow during the autumn and winter. Since rainfall events are unpredictable in the long term, these variations are not included in the predictions.

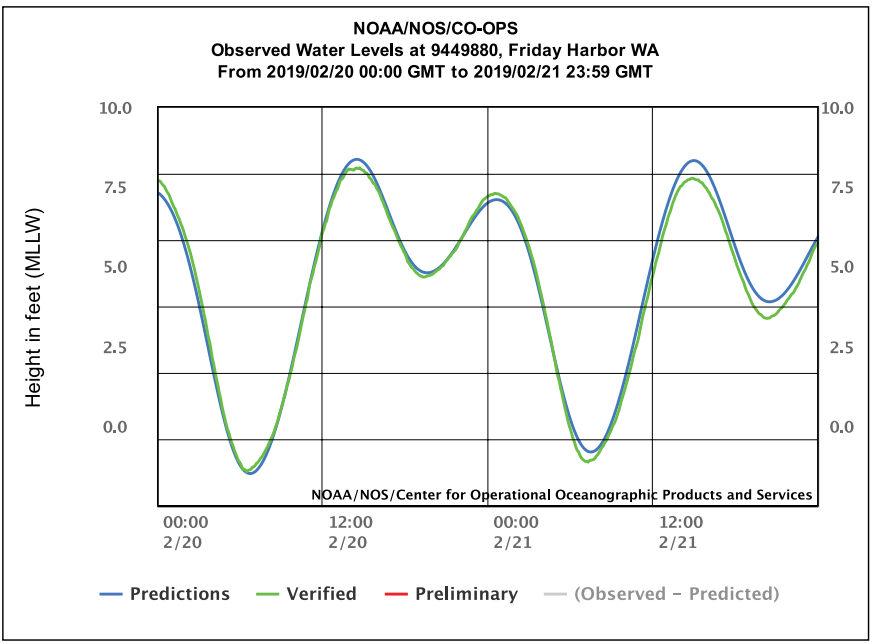
Some current predictions may be valid for a large area with very minor variations. For example, the current predictions for Johnstone Strait Central may be used (with suitable secondary corrections) throughout Queen Charlotte Strait but, in that case, the currents are relatively weak and therefore not of vital interest to mariners. However, in restricted passages, vast volumes of water are forced through a narrow opening and the current speeds may exceed ten knots, often with a great deal of turbulence. As these passages are of the most interest to mariners, they are specifically featured in this book.

The result of all these factors is that the actual water levels may deviate from the predicted levels by up to two feet (0.6 metres) or even more in rare circumstances. These variations in tidal height also have an impact on the times of high and low water, as well as the times of minimum and maximum current. Vessel operators must take these factors into consideration when planning passages of shallow waters or turbulent rapids and, if the tide or current information is critical to navigation or safety, operators must allow for an appropriate margin of error in tidal height and the times of high/low water or minimum/maximum current.

On the following page are examples of actual water levels plotted against the tidal predictions for December 20 and 21, 2018, (the pre-Christmas storm of 2018) and February 20 and 21, 2019, at Friday Harbor, WA. In the first graph, the effect of the devastating pre-Christmas storm of 2018 is clearly visible. High water on that date was more than 2 feet higher than predicted.

Comparison of observed and predicted water levels for any tidal station in the US may be found at **https://tidesandcurrents.noaa.gov/tide_predictions.html**. For Canada, the same may be found **https://tides.gc.ca/tides/en/stations**.


NOAA/NOS/CO-OPS
Observed Water Levels at 9449880, Friday Harbor WA
From 2018/12/20 00:00 GMT to 2018/12/21 23:59 GMT
Height in feet (MLLW)
12.5
10.0
7.5
5.0
2.5
0.0
2018 Pre-Christmas Storm
NOAA/NOS/Center for Operational Oceanographic Products and Services
00:00 12/20
12:00 12/20
00:00 12/21
12:00 12/21
Predictions
Verified
Preliminary
(Observed – Predicted)


NOAA/NOS/CO-OPS
Observed Water Levels at 9449880, Friday Harbor WA
From 2019/02/20 00:00 GMT to 2019/02/21 23:59 GMT
Height in feet (MLLW)
10.0
7.5
5.0
2.5
0.0
NOAA/NOS/Center for Operational Oceanographic Products and Services
00:00 2/20
12:00 2/20
00:00 2/21
12:00 2/21
Predictions
Verified
Preliminary
(Observed – Predicted)

Generally, current predictions are valid only at a specific location. For example, in Dent Rapids, the zone of maximum current speed is only a few hundred metres in extent and, with that zone, the current may vary considerably both in speed and direction. Therefore, the predictions for each current station refer to the latitude and longitude specified in the tables. In narrow channels, the predictions refer to the middle of the navigation channel.

Accuracy of Tidal and Current Predictions

To acquire tide and/or current data, regular observations are taken at a desired location. From these observations, a complicated curve is developed showing how the height of tide (or current speed) changes over time. This curve is the result of the interaction of a number of constituent curves or "constituents". Some Canadian tide stations have been reduced to more than 100 individual constituents, though most tidal predictions employ less than 40.

The accuracy of tide and current predictions depends on the quality and quantity of the tidal data used to compute them. Generally, the data from a reference port is higher quality than the data from a secondary port because it is the result of a much longer set of observations. For some secondary stations, the observation period may be as little as one month.

National hydrographic agencies regularly update the constituents used to predict tides and currents. This results in regular changes to tide and current predictions. In 2016 and 2017, NOAA conducted an extensive study of the currents in Juan de Fuca Strait and made significant changes to the constituents for stations throughout Juan de Fuca Strait, Rosario Strait and Puget Sound. Because of these studies, a new reference station was created at Lawrence Point.

Smartphone and computer apps used to predict tides may tell you they are good for 100 years but, if they are not using all the updated constituents, over time they will diverge more and more from the predictions from national hydrographic agencies (which are the most accurate). **Ports and Passes** uses only data from the Canadian Hydrographic Service and the US National Oceanic and Atmospheric Administration.

Ports and Passes includes predictions for most reference tide and current stations, as well as some secondary stations. We expend great effort to make our book as accurate and as true to the original data as possible. However, there may be significant differences between the predicted and actual heights of tide and current speeds as a result of natural forces. Meteorological conditions may advance or retard the timing, height or speed of a tide or current event. Remember, predictions are just that—they are predictions, not facts. In addition, CHS and NOAA may recalculate tide and current data after **Ports and Passes** has gone to press. Normally, this will result in only minor differences. The publisher or distributor cannot assume any liability for errors or omissions as a result.

There may be some variation from other publications in the way that the information in **Ports and Passes** is depicted. The following is a further explanation as to why.

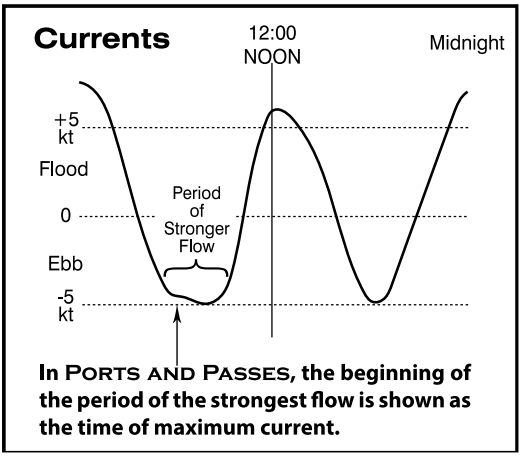
Currents and Tides

When current speeds (or tidal heights) for a particular station are plotted on a graph, the curves for most tide and current stations show remarkable symmetry, but there are other tide and current stations that are very asymmetrical in nature.

- In the case of a tide station at high water, the tide may "hover" for a period or it may drop a little and then rise again. This is known as the “stand” of the tide. Normally, **Ports and Passes** assigns the time of high or low water to the beginning of the “stand” of the tide.

- Another possibility is that, following high water, the tide may drop for several hours and then “hover” for an hour or two before dropping again.

- In Ports and Passes, the speed of flow may increase rapidly to a maximum and then plateau for an extended period. This is indicated by a bold box around the time of the beginning of the "hovering" period. Another possibility is that the ebb current speed will drop to a minimum and may plateau at a minimum ebb before increasing to a maximum again. In this case, there is never a true slack when current speed is zero. Instead, it is just an extended period of minimum current. **Ports and Passes** assigns the time of maximum flood or ebb to the beginning of the period of strongest flow and the time of slack water to the beginning of the period when the current is at its weakest.



In Ports and Passes, the beginning of the period of the strongest flow is shown as the time of maximum current.







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Working with Tide and Current Predictions

WORKING WITH PREDICTIONS

To Estimate Approximate Intermediate Tidal Height

1) From the tables, calculate the duration and range of the current tide (rising or falling) and the time elapsed since the last high or low tide.

Range: the difference in height between the previous high or low tide and the following low or high tide.

Duration: the time between the previous high or low tide and the following low or high tide.

Example: To calculate the tide height at 3:00 AM...

Time	Height (ft)	Height (m)
12:45 AM	2.7	0.8
6:15 AM	14.2	4.3
12:55 PM	5.6	1.7
7:10 PM	9.8	3.0

Tide is rising

Range = 14.2 ft - 2.7 ft = 11.5 ft

Duration = 5 hrs 30 min (5.5 hours)

Elapsed time = 2 hrs 15 min (2.25 hours)

2) Find the point on the **Duration** scale that equals a duration of 5.5 hours. Draw a line horizontally from this point.

3) Find the point on the lower scale representing the **Hours Since Last High or Low Water**. For 2.25 hours (2hrs 15min), this point lies midway between the curves representing 2.0 and 2.5 hours. Draw a curved line midway between the curves for 2.0 and 2.5 hours until it intersects the line you drew in step 2 (Point **A**).

4) Draw a line vertically from Point **A** until it intersects with the appropriate tidal curve (Point **B**). In this example, Point **B** is on the rising tide curve.

5a) **Rising Tide**

Point **B** is on the rising tide curve.

From Point **B**, follow a horizontal line to the "**Percent of Tidal Range**" scale. In this example, the correct value is approximately 34%.

Multiply the **Range** by this value (34%) and add to the height of the *previous low tide*.

34% X 11.5 ft = 3.9 ft (1.2m)

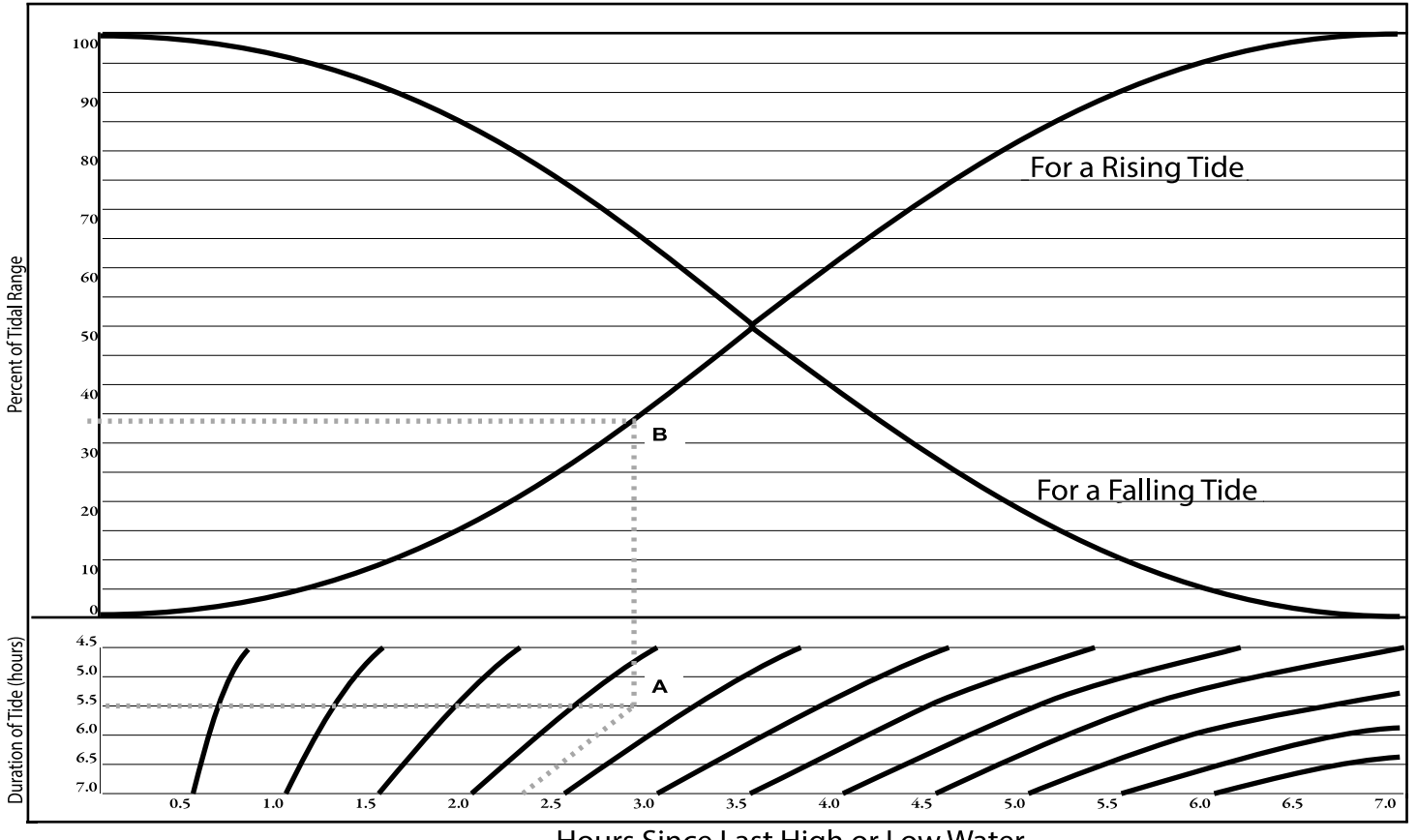
Current height of tide = 3.9 ft (1.2m) + 2.7 ft (0.8m) = 6.6 ft (2.0m)

5b) **Falling tide**

Point **B** is on the falling tide curve.

From Point B, follow a horizontal line to the "**Percent of Tidal Range**" scale.

Multiply the Range by this value and add to the height of the ***following low tide***.


Percent of Tidal Range
100
90
80
70
60
50
40
30
20
10
0
For a Rising Tide
For a Falling Tide
B
Duration of Tide (hours)
4.5
5.0
5.5
6.0
6.5
7.0
A
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
4.5
5.0
5.5
6.0
6.5
7.0
Hours Since Last High or Low Water

Rules of Thumb

The "Rule of Twelfths" for Estimating Intermediate Tidal Height

The "Rule of Twelfths" is a rule of thumb that will assist you to make a quick estimate of intermediate tidal heights. This rule of thumb assumes that as the tide rises (or falls), it begins to change slowly and then reaches its maximum rate of change halfway between high water and low water, after which it reduces smoothly to zero again at the end of the tidal cycle.

The rule assumes that, for a six-hour duration, in the first hour the tide rises 1/12 of the range, in the second hour an additional 2/12 of the range, and in the third hour a further 3/12 of the range. Thus, by the end of the third hour, the tide has risen one half its range (1/12 + 2/12 + 3/12 = 6/12 or 1/2).

Fractional Rise or Fall of Tide		Total Rise or Fall of Tide: Fraction / Percent of Total Range	
Hour Zero		$\frac{0}{12}$	0%
During 1st hour, tide rises/falls 1/12 of the range	at end of 1st hour	$\frac{1}{12}$	8.3%
During 2nd hour, tide rises/falls 2/12 of the range	at end of 2nd hour	$\frac{3}{12}$	25%
During 3rd hour, tide rises/falls 3/12 of the range	at end of 3rd hour	$\frac{6}{12}$	50%
During 4th hour, tide rises/falls 3/12 of the range	at end of 4th hour	$\frac{9}{12}$	75%
During 5th hour, tide rises/falls 2/12 of the range	at end of 5th hour	$\frac{11}{12}$	91.7%
During 6th hour, tide rises/falls 1/12 of the range	at end of 6th hour	$\frac{12}{12}$	100%

Example

Low water	6:05 AM	4.7 ft
High water	12:15 PM	15.3 ft

Range = 15.3 ft. – 4.7 ft = 10.6 ft

To find the height of tide at 11AM (approx 5 hours after low water)

Rise of tide after 5 hours = 91.7% x 10.6 ft = 9.7 ft.

Height of tide after 5 hours = 4.7 ft + 9.7 ft = 14.4 ft

If the duration of the tide is more (or less) than 6 hours, adjust the estimate accordingly.

The "Rule of Thirds" for Estimating Intermediate Current Speeds

The "Rule of Thirds" assumes that maximum current strength occurs halfway between the turns of the current. You can obtain the time of the turn of the current from "Current Tables". The time of increasing (or decreasing) current is then divided into thirds. For a six-hour current cycle, estimate as follows:

Hour Zero	0% of maximum speed (slack water)
End of 1st hour	50% of maximum speed
End of 2nd hour	90% of maximum speed
End of 3rd hour	100% of maximum speed
End of 4th hour	90% of maximum speed
End of 5th hour	50% of maximum speed
End of 6th hour	0% of maximum speed (slack water)

If the duration of the current is more (or less) than 6 hours, adjust the estimate accordingly.

Duration of Weak Current Near Time of Slack

The safest time to negotiate any narrows is during the period of slack or minimal current. There is a period on each side of the predicted time of slack water during which the current is very weak and safely navigable.

The table below helps approximate the length of time during which these weak currents can be expected. The duration given refers to the entire period of time encompassing the turn—half of the period will be before, and half of the period will be after, the time of slack water.

Occasionally, in areas of extremely swift currents, a time of "slack water" does not occur. In these areas, the current will change direction or "turn" instantaneously without ever being slack. For Deception Pass and Seymour Narrows, expect the duration of slack to be between 25% and 50% less than in the table below.

Maximum Current	**Period with a speed not more than:**				
	0.1 knot	**0.2 knot**	**0.3 knot**	**0.4 knot**	**0.5 knot**
knots	*minutes*	*minutes*	*minutes*	*minutes*	*minutes*
1.0	23	46	70	94	120
1.5	15	31	46	62	78
2.0	11	23	35	46	58
3.0	8	15	23	31	38
4.0	6	11	17	23	29
5.0	5	9	14	18	23
6.0	4	8	11	15	19
7.0	3	7	10	13	16
8.0	3	6	9	11	14
9.0	3	5	8	10	13
10.0	2	5	7	9	11

Canadian and US Chart Differences

The nautical charts for Canada are produced by CHS (Canadian Hydrographic Service). In the US, NOAA (National Oceanic and Atmospheric Administration) is responsible for nautical charts. Each country publishes a Chart No. 1 which contains the chart symbols and basic layout. Most symbols and abbreviations are the same but there are some very important differences. We suggest that everyone should have a copy of Chart No. 1 to refer to if they are unsure of the meaning of any symbol. Most of us are aware that almost all CHS charts are metric, which shows the soundings in metres, while many US charts continue to display the depth in fathoms (and feet). A metre is just over three feet (3.28 feet); a fathom (6 feet) is a little less than two metres, measuring at 1.829 metres.

In Canadian tidal waters, CHS charts use the level of either Lower Low Water, Large Tides, or Lowest Normal Tide as the plane of reference for soundings and elevations. As a result, low tides that go below tide datum—known as “minus tides”—are very rare. However, in US tidal waters, NOAA charts use Mean Lower Low Water (MLLW) as the tidal datum. This can differ as much as 1.5 metres from Canadian datum. As a result, “minus tides” are common in the US.

Chart datum differences also affect the way we look at elevations and clearances. Canadian charts generally give elevations (heights of lights, rocks and islands) and clearances (heights under structures such as bridges and power lines) above Higher High Water, Large Tides. This means that clearances and elevations will seldom be less than what is shown on the chart. US charts use Mean High Water with half of the high waters rising above the mean high water level. As a result, the clearance below bridges may sometimes be less than the clearance specified on the chart.

You should be aware that any CHS charts which include US tidal waters use the US chart datum for those areas. NOAA charts that include Canadian tidal waters use the Canadian datum for Canadian tidal waters. Thus, you do not have to read charts differently in the US than in Canada. But, if you have easily passed under a bridge with 30-foot clearance on a 16-foot tide in Canadian waters, you may find that you do not have enough clearance under a 30-foot high bridge on a 16-foot tide in US waters—simply because elevations are calculated from a different high-water datum.

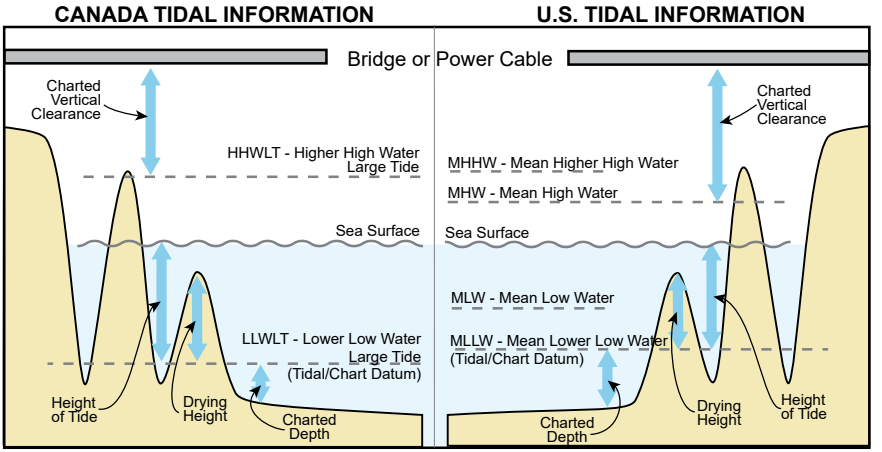


Image courtesy of *Waggoner Cruising Guide*. For more information, see the Compendium (chapter 1) of the 2025 Waggoner Guide, which includes chart datum, Legacy and Re-Schemed ENC Charts information, Tides, Currents, and Tidal Rapids information, weather resources, anchoring, and much more.