U. S. COAST GUARD
VESSEL TRAFFIC SERVICE

HOUSTON GALVESTON
USER'S MANUAL

Updated November 2002

VTS Houston/Galveston

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Marine Safety Office (MSO) Houston- (713)671-5100 (24 Hours) VHF-FM CH 81

Marine Safety Unit (MSU) Galveston (409) 766-5400 VHF-FM CH 83

Coast Guard Group Galveston (409) 766-5620 (24 Hours) VHF-FM CH 16

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INTRODUCTION

Coast Guard Vessel Traffic Service (VTS) Houston/Galveston is a mandatory vessel movement reporting system established under the authority of the Ports and Waterways Safety Act of 1972 (PWSA). VTS Houston/Galveston was commissioned in 1975 in response to concerns for maritime safety along the Houston Ship Channel, adjacent harbors and connecting waterways. The purpose of the Vessel Traffic Service is to increase the good order and predictability of local ship channels, adjacent harbors, and connecting waterways by collecting, analyzing, and disseminating information contributing to safe navigation. The goal is to reduce the potential for groundings, allisions, and collisions; and to protect people, property, and waterways in the Vessel Traffic Service Area (VTSA) from environmental harm, injury, or damage resulting from marine mishaps. VTS accomplishes this mission through the use of various surveillance equipment systems, monitoring of bridge-to-bridge communications, the Vessel Movement Reporting System (VMRS), proactive analysis of channel/traffic conditions, and the exchange of information with mariners.

MARINERS ARE CAUTIONED THAT REPORTS PROVIDED BY THE VTC ARE BASED LARGELY UPON INFORMATION RECEIVED FROM VTS PARTICIPANTS. VTS REPORTS CAN BE NO MORE ACCURATE THAN THE INFORMATION PROVIDED.

The Coast Guard welcomes any suggestions that may improve this manual or VTS Houston/Galveston . Suggestions may be forwarded to the Commanding Officer of VTS Houston/Galveston at the address or website listed on the inside front cover of this manual.

APPLICABILITY
(33 CFR PART 161)

Two levels of required participation exist in the Houston/Galveston Vessel Traffic Service Area (VTSA):

VESSEL MOVEMENT REPORTING SYSTEM (VMRS) USERS

- Every power-driven vessel of 40 meters (approx. 131 feet) or more in length, while navigating;

- Every towing vessel of 8 meters (approx. 26 feet) or more in length, while

navigating;

- Every vessel certificated to carry 50 or more passengers for hire, while engaged in

trade.

VESSEL TRAFFIC SERVICE (VTS) USERS

- All vessels subject to the Vessel Bridge-to-Bridge Radiotelephone Act;

- All vessels required to participate in a VMRS within a VTSA.

VTS Users shall notify the VTS of any of the following;

(1) Marine Casualty as defined in 46 CFR; Part 4.05-1;

(2) Involvement in the ramming of a fixed or floating object;

(3) A pollution incident as defined in 33 CFR, Part 151.15;

(4) A defect or discrepancy in an aid to navigation;

(5) A hazardous condition as defined in 33 CFR, Part 160.203;

(6) Improper operation of vessel equipment required by 33 CFR, Part 164; and

(7) A hazardous vessel operating condition as defined in 33 CFR, Part 161.2.

VTS Users shall carry on board and maintain for ready reference a copy of these VTS rules (e.g., VTS User Manual, Coast Pilot, etc.).

APPLICABILITY

INDIVIDUAL RESPONSIBILITIES

The safe operation of a vessel remains the responsibility of the vessel's master. If, in a specific circumstance, a VTS User is unable to safely comply with a measure or direction issued by the VTS, the VTS User may deviate only to the extent necessary to avoid endangering persons, property, or the environment. The deviation shall be reported to the VTS as soon as is practicable.

VTS MEASURES

The VTS may issue measures and directives to enhance navigation and vessel safety, and to protect the marine environment, such as, but not limited to:

(1) Designating temporary reporting points and procedures;

(2) Imposing vessel operating requirements; or

(3) Establishing vessel traffic routing schemes.

TRAFFIC ADVISORIES: VTS Houston/Galveston's traffic advisories at each reporting point may consist of the following information:

(1) Traffic:

- All anticipated meeting situations before the next reporting point;

- All anticipated crossing situations before the next reporting point;

- All anticipated overtaking situations.

(2) AtoN - all critical AtoN (see GOOD THINGS TO KNOW)

(3) Channel Hazards

(4) VTS Measures

COMMUNICATIONS

VOICE CALL SIGNS

The Vessel Traffic Center (VTC) call sign is **"HOUSTON TRAFFIC"**. VTS Houston/Galveston requires captains/pilots to use the vessel's official name when calling the VTC. Houston, Galveston and Texas City pilots may use their individual identification number, in addition to the vessel's name. All communications must be in the English language.

DESIGNATED FREQUENCIES

- VHF-FM Channel 05A (156.250 MHz) is used for **Initial Check-In** with Houston Traffic. All vessels checking in to the system must first contact Houston Traffic on this frequency prior to shifting to the appropriate working frequency (Channel 11/12).

- VHF-FM Channel 11 (156.550 MHz) for communicating with Houston Traffic inbound at Baytown Bend Light 113, or operating above that location in either direction.

- VHF-FM Channel 12 (156.600 MHz) outbound at Baytown Bend Light 113, or operating below that location in either direction.

VTS Users not maintaining a listening watch on the VTS frequency, are required to monitor VHF-FM Channel 16 (156.800 MHz) and the vessel Bridge-to-Bridge frequency, VHF-FM Channel 13 (156.650). Vessels which maintain a listening watch on the VTS frequency are not required to monitor VHF Channel 16 while operating in the VTSA.

REPORTING WAIVERS

On July 2, 1996, The Eighth Coast Guard District Commander waived the 33 CFR 162.23 requirement concerning ferry Sailing Plans. VTS will continue to report how many ferries are in operation.

On August 1, 1997, the Eighth Coast Guard District Commander waived the 33 CFR 161.19 requirement concerning 15 minute Sailing Plans. However, vessels shall provide sailing plans in sufficient time to allow advance traffic planning by the mariner and the VTC.

REQUIRED REPORTS FOR VMRS USERS

SAILING PLAN: VMRS Users must report the following information via VHF-FM Channel 5A prior to entering the VTSA or getting underway (preferrably in this order):

- Vessel Name;

- From (Origination Point);

- To (Destination);

- Tow Configuration (How many and # of loaded/unloaded barges/if any bottle barges);

- Vessel's Dimensions (Length x beam x draft);

- Bunker Info (If Applicable);

- Next Port of Call (For all outbound piloted vessels);

- Other.

POSITION REPORT: VMRS Users must report its name and position;

(a) Upon point of entry into a VTS area;

(b) At designated reporting points;

(c) When directed by the VTC.

SAILING PLAN DEVIATION REPORT: VMRS Users must report;

(a) When its ETA to a destination varies significantly from a previously-reported ETA;

(b) Any intention to deviate from a VTS-issued measure or vessel traffic routing system;

(c) Any significant deviation from previously-reported information.

FINAL REPORT: VMRS Users must report its name and position;

(a) On arrival at its destination; or

(b) When leaving a VTS area.

ADDITIONAL REQUIRED REPORTS

CHANNEL OBSTRUCTION:

Operations which will obstruct any portion of the navigable channel/waterway, must be approved by the Captain of the Port (COTP) prior to the operation. Channel Closure Permit Applications may be obtained via MSO Houston/Galveston website or VTS Houston/Galveston website at: www.uscg.mil/d8/mso/hougal/obstructions/index.htm. Before commencing the operation, the VTC must know the following;

- Name of vessel/s;

- Location;

- Reason for obstruction;

- Description of obstruction;

- Estimated duration;

- Tugs in attendance (if applicable).

MARINE INCIDENT REPORTS (CG-2692):

Report any grounding, fire, loss of steering, loss of propulsion, collisions, rammings, flooding, or other circumstance that reduces the capability of a vessel to safely maneuver or that endangers another vessel. Include in your report the following information:

- Vessel name;

- Location;

- Nature of incident;

- If Coast Guard assistance is needed;

- Extent of channel restrictions;

- Is there damage, pollution, or injuries as a result of the incident;

- Master's intentions.

ADDITIONAL REQUIRED REPORTS

DISTRESS REPORTS:

Report flare sightings, distress calls, or sightings of vessels possibly in distress to the VTC with the following;

- Location;

- Nature of distress;

- Description of vessel/s in distress;

- If your vessel is able to assist.

FERRY VESSELS:

Vessels on a published schedule or route, which has been furnished to the VTS, are exempt from providing Sailing Plans, Position Reports, and Final Reports unless deemed necessary by the vessel's master or VTC controller. Ferries, must report mechanical casualties or conditions which may affect their safe navigation; 33 CFR, Part 161.12 (c).

DREDGES AND FLOATING PLANTS:

- Name;

- Location of intended operation;

- Description of intended operation – including any channel obstructions;

- Configuration of pipeline;

- Termination point of pipelines;

- Time required to re-open the channel for vessel passage;

- Any operating impairments;

- Any notification requirements to channel traffic (e.g., requests for SLOWBELL, no meeting or overtaking, divers in the water, etc.);

- Means of contacting the dredge control station;

- Telephone numbers and names of assist vessels;

- Telephone number and name of project superintendent.

VTS REPORTING POINTS

All vessels, required to participate in the VTSA as a Vessel Movement Reporting System user, must report at the following points on the appropriate VTS frequency and when entering or departing the VTSA:

1. Houston-Galveston Entrance Jetty Channel Lighted Buoy “GB”
2. Houston-Galveston Entrance Jetty Channel Lighted Buoys II & 12
GCG. Galveston Coast Guard Base (vicinity of Galveston Harbor Buoy 1)
T. Texas City Channel Light 12 (for vessels inbound or outbound in Texas City Channel)
E. Bolivar buoy line at ICW mile marker 349
W. Pelican Cut at ICW mile marker 351
X. Houston Ship Channel Lighted Buoys 25 & 26 (for all tows inbound from Texas City or the ICW)
3. Houston Ship Channel Lights 31 & 32
4. Houston Ship Channel Lights 53 & 54 (Redfish Bar)
4A. Houston Ship Channel Lights 69 & 70 (for all tow vessels)
P. Bayport Ship Channel Lights 8 & 9
5. Morgan’s Point (vicinity of HSC Light 91)
6. Exxon Ship Dock #1 (vicinity of Baytown Bend Light 113)
7. Lynchburg Ferry Crossing
8. Shell oil Company Slip (vicinity of HSC Light 142)
9. Greens Bayou (vicinity of HSC Light 152)
10. William’s Turning Basin (vicinity HSC Light 160)
11. Lyondell Turning Basin
12. I-610 (Sidney Sherman) Bridge
13. Houston Turning Basin

GOOD THINGS TO KNOW

AtoN (Aid to Navigation): Any private, state, or federally maintained light, beacon, or buoy. VTS continuously monitors the status of all AtoN within the VTSA. To avoid redundancy and unduly congested radiotelephone frequencies, VTS will normally report only critical AtoN discrepancies and/or critical AtoN situations in VTS traffic advisories. If additional AtoN information is needed, simply ask your controller. The following aids are considered "critical" AtoN:

- Houston-Galveston Entrance Jetty Channel Lighted Buoys 7, 8, 9, and 10; Lighted Bell Buoy 16; and Pelican Is. Spit Shoal Lighted Buoy "P"

- Houston Ship Channel Lighted Bell Buoy 18; Lighted Buoys 25 & 26; Lights 51, 52, 75, & 76, and 127

- Texas City Channel Lights 9, 10, & 17

- San Jacinto Junction Light “SJ”

- Carpenter’s Bayou Entrance Buoy 2

- All range lights

A critical AtoN situation exists any time:

- a floating aid is reported off station.

- adjacent aids become discrepant (regardless of criticality). (e.g., Lights 45 & 47 or Lights 45 & 46).

- any time a range light is discrepant, the aids within that reach will be treated as "critical" aids. (e.g., If Upper Galveston Bay Inner Range Front Light is extinguished, lights 53-74 will be handled as "critical" until the range is repaired and left watching properly).

Coast Guard Group Galveston broadcasts AtoN discrepancy information, including AtoN within the VTSA, on VHF-FM Channel 22A four times daily at 0450, 0650, 1050, and 1650 (local time).

GOOD THINGS TO KNOW ...

DREDGE OPERATIONS: The Army Corps of Engineers (ACOE) is responsible for permitting dredge projects within the VTSA. VTS will monitor all dredging operations, reporting the following:

- dredge location

- pipeline configurations which restrict the channel or impede the flow of traffic

This does not relieve the mariner of the responsibility to communicate with the dredge and make proper passing arrangements in accordance with the Rules of the Road.

FERRY CROSSINGS: The following ferry crossing zones are in the VTSA:

(1) Bolivar Precautionary Area: State operated ferries transit between terminals at Bolivar Peninsula and Galveston Harbor. These ferries operate throughout the year, 24 hours each day. There may be as many as six ferries operating during peak hours, summer months, and holidays. The ferries monitor VHF-FM Channels 13 and 16.

(2) Lynchburg Precautionary Area: State operated ferries transit between the mouth of the San Jacinto River and San Jacinto State Park. These ferries also operate throughout the year and 24 hours a day. There may be as many as two ferries in operation at any one time. The ferries monitor VHF-FM Channels 13 and 16.

DOT FORM 2692: Department of Transportation Form 2692; Report of Marine Accident, Injury, or Death. Vessels are required to document all marine mishaps (i.e., groundings, collisions, allisions, loss of power).

GOOD THINGS TO KNOW ...

VESSEL MOORINGS THAT IMPACT WATERWAY NAVIGATION

To reduce the risks associated with vessel mooring and bunkering operations at critical locations within the VTSA, the Captain of the Port has established restrictions at various facilities. These restrictions were implemented upon agreements developed within the Port community. See appendix i for restricted locations.

A clear channel shall at all times be left open to permit free and unobstructed navigation by all types of vessels and tows normally using the various waterways.

MSO: Marine Safety Office. The Coast Guard office responsible for overseeing the safety of the port and waterway. MSO Houston/Galveston is located in Galena Park, TX.

MSU: Marine Safety Unit. A sub-unit of Marine Safety Office. Marine Safety Unit Galveston is located in the Army Corps of Engineers Building on Galveston Island.

SECURITY ZONES: 33 CFR 165.30 defines a security zone as an area of land, water, or land and water which is so designated by the Captain of the Port or District Commander for such time as is necessary to prevent damage or injury to any vessel or waterfront facility, to safeguard ports, harbors, territories, or waters of the United States or to secure the observance of the rights and obligations of the United States.

SAFETY ZONES: 33 CFR 165.20 defines a safety zone as a water area, shore area, or water and shore area to which, for safety or environmental purposes, access is limited to authorized persons, vehicles, or vessels. It may be stationary and described by fixed limits or it may be described as a zone around a vessel in motion.

VTS MEASURES: 33CFR 161.11 states that a VTS may issue measures or directions to enhance navigation and vessel safety and to protect the marine environment, such as, but not limited to:

(1) Designating temporary reporting points and procedures;
(2) Imposing vessel operating requirements; or
(3) Establishing vessel traffic routing schemes.

During conditions of vessel congestion, restricted visibility, adverse weather, or other hazardous circumstances, a VTS may control, supervise, or otherwise manage traffic, by specifying times of entry, movement, or departure to, from, or within a VTS area.

GOOD THINGS TO KNOW…

HOUSTON-GALVESTON SECURITY ZONES: The Captain of the Port Houston/Galveston has established security zones for certain areas within the Houston/Galveston area. Recreational vessels and unauthorized vessels/persons are excluded from these areas without the express permission from the Captain of the Port. Violators may be subject to civil penalties, fines and/or imprisonment. See www.uscg.mil/d8/vts/houston-galveston/securityzones.htm for further explanation of these areas.

OVERSIZED TOW PERMITS: 33 CFR 162.75 regulates the size, assembly, and handling of tows on waterways 150 feet wide or less. The MSU in Galveston processes all oversize tow permits (OST) for the Gulf Intracoastal Waterway (GICW) during normal business hours (0800-1600). MSO Houston/Galveston processes all OST permits after normal working hours, weekends, and national holidays. The applicable phone numbers and VHF-FM radio frequencies are listed on the inside front cover of this manual.

GOVERNMENT MOORINGS: The Army Corps of Engineers maintains moorings in Bolivar, Pelican Cut, and Atkinson Island for temporary mooring of barges while awaiting weather, repairs, dock space, or orders. Federal Regulations require that any vessel or tow using these areas maintain a clear and unobstructed waterway for other vessel traffic. Vessels must be properly moored, display proper signals, lights, and have a minimum of one crew member on board at all times.

REPORTING POINTS: Also refered to as "check points." The reporting points are specifically assigned geographic positions within the VTSA where VMRS users are required to make position reports. These reports can be found in 33 CFR 161 and pages 8 - 11 of this manual.

SNAKE ISLAND SAFETY ZONE: The safety zone is defined by the west and northwest shores of Snake Island, the turning basin west of Snake Island, and the area of the Texas City Channel from the north end of the turning basin to a line drawn 000 degrees true from the northwesternmost point of Snake Island. All vessels are prohibited from mooring, anchoring, or otherwise stopping in the safety zone, except in case of an emergency. Barges are prohibited from fleeting or pushing-in (i.e., intentionally grounding) within the zone. In an emergency, vessels shall advise the Captain of the Port of the nature of the emergency via the most rapid means available (normally through the VTS).

ICW TRAFFIC: Because of the strong current and narrow channel width, VTS Houston/Galveston recommends all west bound tows avoid meeting east bound tows between Bolivar Peninsula Buoy 15 and Lighted Buoy 20.

GOOD THINGS TO KNOW…

BOLIVAR ICW ALTERNATE ROUTE: As stated in the proposed change to the 29th Edition of the U.S. Coast Pilot #5, "The alternate route for vessels transitting from the Gulf Intra-Coastal Waterway to the Houston Ship Channel is marked from the Bolivar Peninsula Light 20 to Houston Ship Channel Light 28."

TOWING ON A HAWSER (above Morgans Point): It is the policy of the COTP Houston/Galveston that all tows towing a barge astern on a hawser above Morgans Point must have an assist tug on the stern of the barge being towed.

ROCKS AT MORGANS POINT: Because of the submerged rocks, tow vessels are directed not to push in on the green side between Barbours Cut and Morgans Point.

GEORGIA GULF: Whenever a ship is moored at the Georgia Gulf Facility, ships, seagoing barges, tows in excess of 800 feet long and/or 100 feet wide are recommended not to meet or overtake any vessel within 500 yards of the facility.

NOTES

USER MANUAL

APPENDIX

Appendix i - INSHORE ANCHORAGE RESTRICTIONS/MOORING RESTRICITONS

Appendix ii - FACILITY WORKING FREQUENCIES

Appendix iii – VTSA DISTANCE CHART

Appendix i

INSHORE ANCHORAGE

The Bolivar Roads Anchorage is defined by Houston/Galveston Entrance Jetty Channel Lighted Bell Buoys 10, 12, and 16; Anchorage "A" is the "deep water" anchorage, restricted to vessels with a draft greater than 22 feet. Anchorage "A" can be used for temporary anchoring (not to exceed 48 hours). Vessels with a draft of 22 feet or less are prohibited from anchoring in this anchorage without approval. Anchorage "B" is the "shallow" anchorage for vessels with a draft of 22 feet or less. Anchorage “C” is pending approval, but it can be used as an additional “shallow” water anchorage for vessels with a draft of 22 feet or less.

(1) Vessels shall not anchor so as to obstruct the passage of other vessels proceeding to or from available anchorage spaces.

(2) Anchors shall not be placed in the channel and no portion of the hull or rigging of any anchored vessel shall extend outside the limits of the anchorage area.

(3) Vessels using spuds for anchors shall anchor as close to shore as practical, having due regard for the provisions stated above.

(4) Fixed moorings, piles, or stakes, and floats or buoys, for marking anchorages or moorings in place, are prohibited.

(5) Whenever the maritime or commercial interests of the United States so require, the COTP or authorized representatives possess the authority to direct the movement of any vessel anchored or moored within the anchorage area.

Appendix i

MOORING RESTRICTIONS: This section outlines the restricted mooring locations and their specific requirements within the VTSA. Recent changes or modifications may be received by calling the VTC.

Port of Houston City Docks 01, 02, 13, 14, 16, 17, 41, 42, Lyondell C, Vopak Galena Park, Chevron 8 & 9: Prior VTS approval required, No unattended transfers, Active wheelhouse watch, Monitor VHF-FM Channels 13/16, Must be able to move within 30 minutes.

Port of Houston City Docks 03, 04, 27, 28, 32, Old Manchester Docks, New Manchester Dock A, Georgia Gulf, Houston Ammonia: No unattended transfers, Active wheelhouse watch, Monitor VHF-FM Channels13 & 16.

Valero at Manchester, Tra-Week, Kinder Morgan Pasadena 1/2 Barge Docks, Kinder Morgan Pasadena Ship Dock: No Bunkering, Lightering, or Double-ups.

Agri Docks 1, 2 : No Bunkering, Lightering, or Double-ups.

Crown: No Bunkering, Lightering, or Double Ups in excess of 95 foot beam.

Lone Star: No Triple Ups

Arrow, Williams 3 Barge Dock, Williams 1/2 Barge Docks (If ship at Agri): No Double Ups.

Kinder Morgan Pasadena Ship Dock: No mooring of vessels in excess of 750 foot length or 108 foot beam. No Transfer Operations, Double Ups.

Appendix ii

FACILITY	MONITOR	WORKING FREQUENCIES
AMOCO CHEMICAL	16/18	18
BARBOURS CUT SECURITY	14	14
BAYTANK	16	
BOATMAN	14	14
BOLIVAR BARGE TERMINAL	10	10
BUFFALO MARINE	16	18
CHANNEL SHIPYARD	10	10
CROWN REFINERY	472-2465	
DYNEGY TERMINAL	16	04/07
EXXON REFINERY	16	09/19A
FIRST WAVE NEWPARK (HOUSTON)	16	06
FIRST WAVE NEWPARK (PASADENA)	473-5561	
G & H TOWING	7A	09/14
GALVESTON CAUSEWAY BRIDGE	16	14
GALVESTON MARINE OPERATOR	24/28	24/28
GALVESTON/TEXAS CITY PILOTS	14	14/73
HALTERMANS	9	9
HOUSTON FUEL OIL	16	16
HOUSTON MARINE OPERATOR	26	26

HOUSTON MARINE SERVICES	16	80
HOUSTON PILOTS	13/14	14/74
HOUSTON PORT AUTHORITY	14	14
INTERCONTINENTAL TERMINALS	16	68
KINDER MORGAN LIQUID TERMINALS GALENA PARK	8/14/16	8/14/16
KIRBY	16	79A
LYONDELL	16	16
NEWPARK SHIPYARD	18	18
OCCIDENTAL CHEMICAL	476-2378	
OILTANKING	16	06
PELICAN ISLAND BRIDGE	13/16	13/16
PETRO UNITED	16	16
SHELL DEER PARK	16	16
STERLING CHEMICAL	16	16

Appendix ii

TEXAS CITY HARBOR MASTER	16	14
TEXAS PETRO CHEMICALS	08	08
TESORO MARINE	16	16
VALERO TEXAS CITY	16	16
VOPAK DEER PARK	16	16
WESTERN FLEET	10/16	05/10
WILLIAMS ENERGY	10	10
COAST GUARD	**MONITOR**	**WORKING FREQUENCIES**
CG GROUP GALVESTON	16	22A
MSU GALVESTON	83	83
MSO HOUSTON/GALVESTON	81	81
VTS HOUSTON/GALVESTON	05A/11/12/13	05A/11/12

Appendix iii

	GBEC GB	LB 11&12	PIB	GICW	LB 25&26	LT 31&32	CAR	LT 45&46	LT 53&54	LT 59&60	BAYP TB
GBEC GB	0.0	6.6	11.6	10.1	10.4	12.4	16.7	17.0	19.5	24.7	30.9
LB 11&12	6.6	0.0	5.0	3.5	3.8	5.8	10.1	10.4	12.9	18.1	24.3
PIB	11.6	5.0	0.0	5.7	6.1	8.0	12.3	12.6	15.1	20.4	26.6
GICW	10.1	3.5	5.7	0.0	0.4	2.3	6.6	6.9	9.4	14.7	20.9
LB 25&26	10.4	3.8	6.1	0.4	0.0	2.0	8.0	6.6	9.1	14.3	20.5
LT 31&32	12.4	5.8	8.0	2.3	2.0	0.0	8.9	4.6	7.1	12.4	18.6
CAR	16.7	10.1	12.3	6.6	8.0	8.9	0.0	13.5	16.0	21.3	27.5
LT 45&46	17.0	10.4	12.6	6.9	6.6	4.6	13.5	0.0	2.3	7.8	14.0
LT 53&54	19.5	12.9	15.1	9.4	9.1	7.1	16.0	2.3	0.0	5.3	11.5
LT 69&70	24.7	18.1	20.4	14.7	14.3	12.4	21.3	7.8	5.3	0.0	6.2
BAYP TB	31.0	24.3	26.6	20.9	20.5	18.5	27.5	14.0	11.5	6.2	0.0
LT 75&76	27.0	20.4	22.7	17.0	16.6	14.7	23.6	10.1	7.6	2.3	3.9
LT 91	31.7	25.1	27.4	21.7	21.3	19.4	28.3	14.8	12.3	7.0	8.6
LT 113	35.3	28.7	31.0	25.3	24.9	23.0	31.9	18.4	15.9	10.6	12.2
LYNCH	39.3	32.7	35.0	29.3	28.9	27.0	35.9	22.4	19.9	14.6	16.2
CARP	40.3	33.7	36.0	30.3	29.9	28.0	36.9	23.4	20.9	15.6	17.2
LT 142	42.3	35.7	38.0	32.3	31.9	30.0	38.9	25.4	22.9	17.6	19.2
LT 152	44.8	38.2	40.5	34.8	34.4	32.5	41.4	27.9	25.4	20.1	21.7
WLMS TB	46.7	40.1	42.4	36.7	36.3	34.4	43.3	29.8	27.3	22.0	23.6
LYON TB	49.2	42.6	44.9	39.2	38.8	36.9	45.8	32.3	29.8	24.5	26.1
SSB	50.8	44.2	46.5	40.8	40.4	38.5	47.4	33.9	31.4	26.1	27.7
HOU TB	52.8	46.2	48.5	42.8	42.4	40.5	49.4	35.9	33.4	28.1	29.7

Appendix iii

LT 75&76	LT 91	LT113	LYNCH	CARP	LT142	LT152	HESS TB	LYON TB	SSB	HOU TB
27.0	31.7	35.3	39.3	40.3	42.3	44.8	46.7	49.2	50.8	52.8
20.4	25.1	28.7	32.7	33.7	35.7	38.2	40.1	42.6	44.2	46.2
22.7	27.4	31.0	35.0	36.0	38.0	40.5	42.4	44.9	46.5	48.5
17.0	21.7	25.3	29.3	30.3	32.3	34.8	36.7	39.2	40.8	42.8
16.6	21.3	24.9	28.9	29.9	31.9	34.4	36.3	38.8	40.4	42.4
14.7	19.4	23.0	27.0	28.0	30.0	32.5	34.4	36.9	38.5	40.5
23.6	28.3	31.9	35.9	36.9	38.9	41.4	43.3	45.8	47.4	49.4
10.1	14.8	18.4	22.4	23.4	25.4	27.9	29.8	32.3	33.9	35.9
7.6	12.3	15.9	19.9	20.9	22.9	25.4	27.3	29.8	31.4	33.4
2.3	7.0	10.6	14.6	15.6	17.6	20.1	22.0	24.5	26.1	28.1
3.9	8.6	12.2	16.2	17.2	19.2	21.7	23.6	26.1	27.7	29.7
0.0	4.7	8.3	12.3	13.3	15.3	17.8	19.7	22.2	23.8	25.8
4.7	0.0	3.6	7.3	8.6	10.6	13.1	15.0	17.5	19.1	21.1
8.3	3.6	0.0	4.0	5.0	7.0	9.5	11.4	13.9	15.5	17.5
12.3	7.6	4.0	0.0	1.0	3.0	5.5	7.4	9.9	11.5	13.5
13.3	8.6	5.0	1.0	0.0	2.0	4.5	6.4	8.9	10.5	12.5
15.3	10.6	7.0	3.0	2.0	0.0	2.5	4.4	6.9	8.5	10.5
17.8	13.1	9.5	5.5	4.5	2.5	0.0	1.9	4.4	6.0	8.0
19.7	15.0	11.4	7.4	6.4	4.4	1.9	0.0	2.5	4.1	6.1
22.2	17.5	13.9	9.9	8.9	6.9	4.4	2.5	0.0	1.6	3.6
23.8	19.1	15.5	11.5	10.5	8.5	6.0	4.1	1.6	0.0	2.0
25.8	21.1	17.5	13.5	12.5	10.5	8.0	6.1	3.6	2.0	0.0