SHALLOW WATER SOURCE CONTROL GUIDANCE DOCUMENT V1.6

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Abstract

“The materials generated for this report, inclusive of the appendices, were generated from a volunteer effort within the OOC Shallow Water Source Control Workgroup. These materials drew upon lessons learned from multiple operators and contractors from a wide variety of activities. Each operator or entity is solely responsible for verification and modification of these materials for their organization's needs prior to use. The OOC, its staff and all of the contributing volunteers assume no liability for the content or use of the produced materials."

OFFSHORE OPERATORS COMMITTEE

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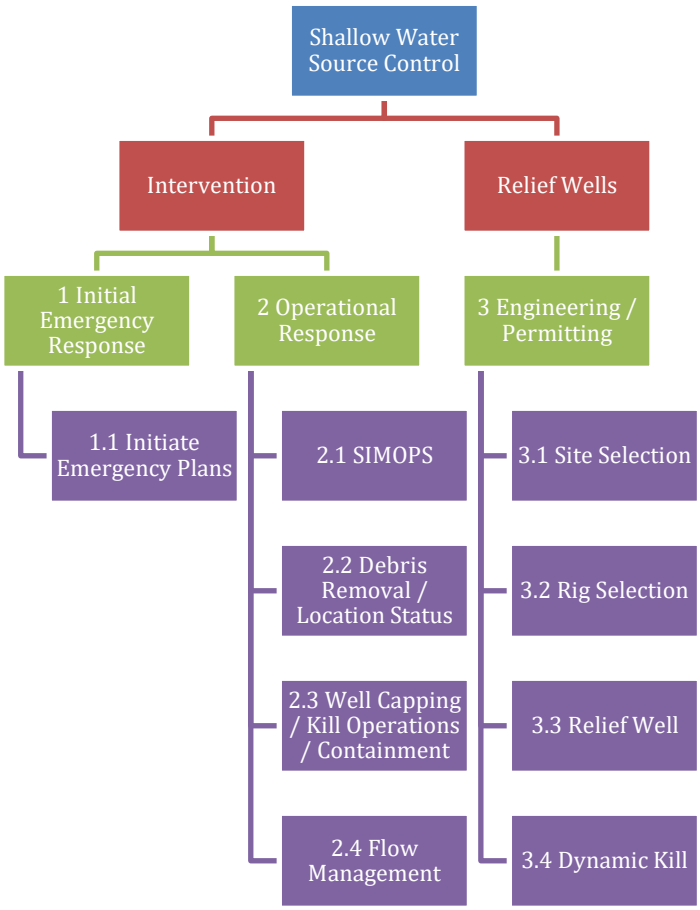
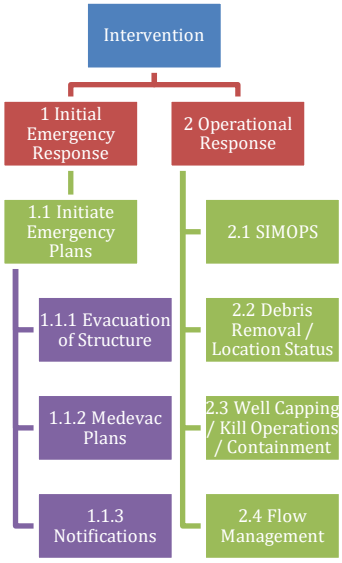
Shallow Water Source Control

The following is a guide of intervention and relief well services which may need to be performed in the event of a shallow water surface stack source control event.



Intervention

After the initial emergency response phase, intervention activities may begin to address source control. This section outlines the general considerations for intervention planning and operations. While initial mitigations are executed, a continuous loop of evaluation and action may take place inclusive of the general elements outlined in the diagram below.



1 Initial Emergency Response

Initial Life Saving and Firefighting Actions as per the Emergency Evacuation Plan and Oil Spill Response Plan.

1.1 Initiate Emergency Plans

Personnel utilized emergency plans for Emergency Shut-Down of all equipment, secure and evacuate structure.

1.1.1 Evacuation of Structure

As per structure specific Emergency Response Plan.

1.1.2 Medevac Plans

As per structure specific Emergency Response Plan, execute emergency Medevac plans for any person(s) injured during evacuation. Mobilize aircraft to closest structure for evacuation. May include seaplane depending on sea state.

1.1.3 Notifications

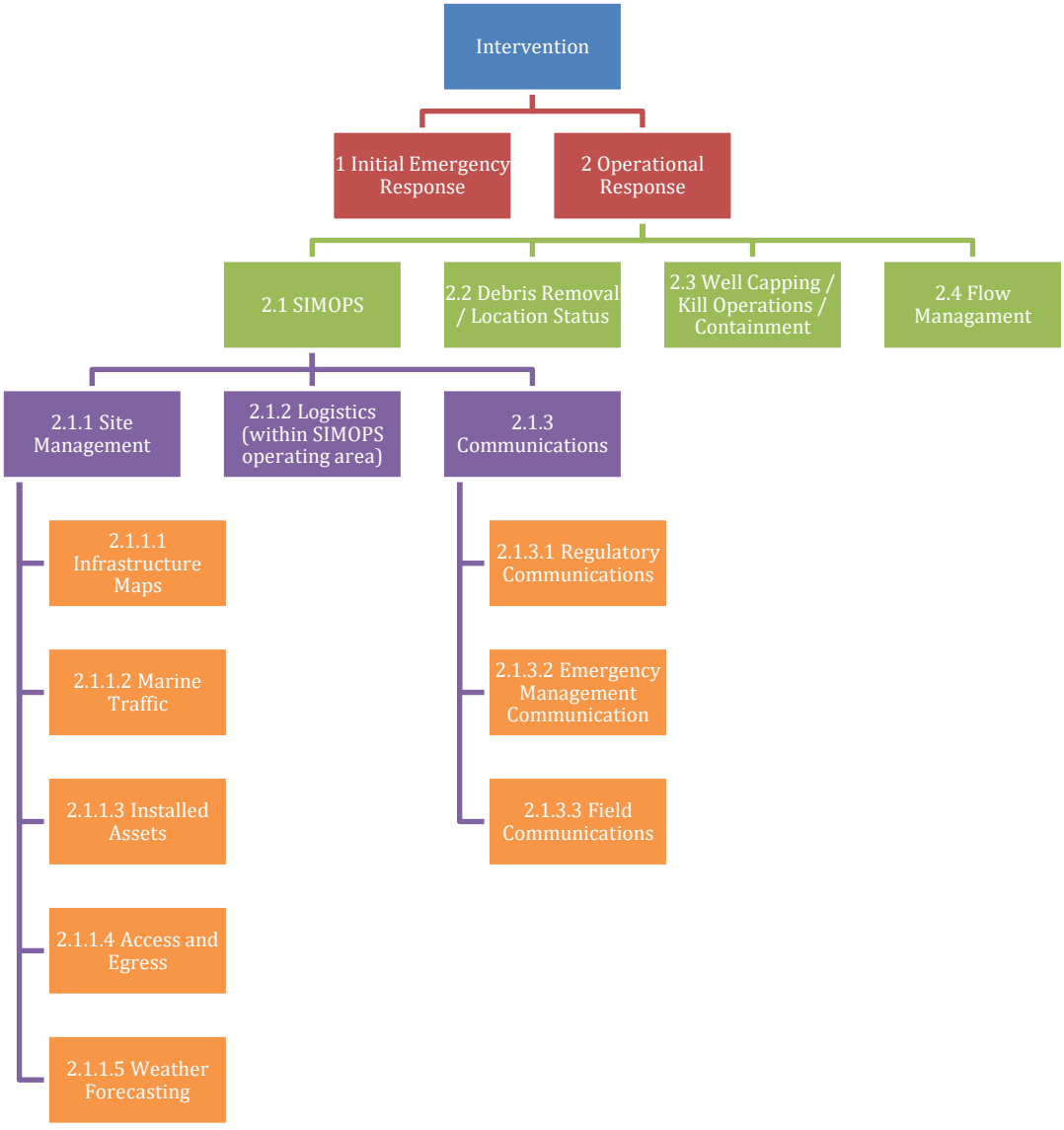
As per structure specific Emergency Response Plan, execute emergency notification protocols as outlined in emergency plans including governmental and senior company personnel (as per each companies IMT/CMT Emergency Response Plan).

2 Operational Response

Continuous updating of appropriate response plans within Real Time while formulating, modifying and performing action plans.

2.1 SIMOPS

SIMOPS stands for Simultaneous Operations and is defined as performing two or more independent operations concurrently that might cause conflicts with one another which may potentially impact the safety of personnel or equipment and the environment of another operation. The following diagram outlines the general considerations for SIMOPS covered within this subsection.



2.1.1 Site Management

SIMOPS refers to coordination to ensure safe and efficient operation between all assets operating within the SIMOPS zone/source control area of operation including source control and non-source control (spill response, etc.) assets.

2.1.1.1 Infrastructure Maps

In order to properly manage the variety of efforts, seafloor interactions and general operations of the vessels in the field during a response, it is critical to have accurate infrastructure maps of the field and surrounding areas. It is beneficial to have adequate detail so that valve locations, pipeline tie-in points, and other structure interactions are all clearly known.

2.1.1.2 Marine Traffic

Refers to all aircraft and marine vessels in the vicinity of the incident area such as planes, helicopters, drones, firefighting vessels, supply vessels, pumping/stimulation vessels, dive vessels, ROV's, barges, tugs, lift boats, rigs, etc. In addition to the oil industry interests described above it also includes commercial aviation & marine interests which may be impacted due to proximity to flight corridors or shipping lanes.

2.1.1.3 Installed Assets

Refers to surrounding assets in relatively close proximity to the incident site that are in place at the time of the incident. These assets might include, but are not limited to, rigs, lift boats, platforms, facilities, pipelines or other sea floor infrastructure, dive vessel, pipe lay barges, etc. Consideration should be given to determining if these assets could be impacted by the incident or the response effort.

2.1.1.4 Access and Egress

Refers to the predefined and controlled procedure for entering into and as well as exiting the incident area as defined by the SIMOPS group. Typically this involves establishing hot, warm, & safe zones for personnel & equipment. Factors such as debris, wind, current, plume may be considered as well as test equipment measurements to determine levels of hazard (LEL, H2S, dB, Heat Load).

2.1.1.5 Weather Forecasting

Utilization of the IMT's central source for metocean and weather forecasting can aid in the proper orchestration of all response activities. Management includes ability to verify with reasonable certainty that adequate weather windows exist for weather critical operations and for adequate warning of potential hurricanes during hurricane season.

2.1.2 Logistics (within SIMOPS operating area)

SIMOPS group coordinates and schedules all activities within the SIMOPS area. Also coordinates with other groups for the transport of all materials and personnel to the site. Consideration should be given to:

- How the SIMOPS group coordinates and schedules all sea and shorebase activities within the SIMOPS area. Also coordinates with other groups for the transport of all materials and personnel to the site.
- How the SIMOPS group coordinates and schedules all air activities within the SIMOPS area. Also coordinates with other groups for the transport of all materials and personnel to the site.
- How the SIMOPS group coordinates and schedules all ground transportation activities including receiving chain-of-custody material and storage within a secure holding site. Also coordinates with other groups for the transport of materials and personnel to the site.

2.1.3 Communications

SIMOPS group develops a detailed communications plan to ensure that all responders understand and abide by SIMOPS requirements within the defined SIMOPS area/zone. SIMOPS group maintains constant communications with the Source Control Section and with other operations functions (e.g. Air operations, Spill Response).

2.1.3.1 Regulatory Communications

Refers to methods and scheduling communication from the response team to the regulatory function within the IMT.

2.1.3.2 Emergency Management Communication

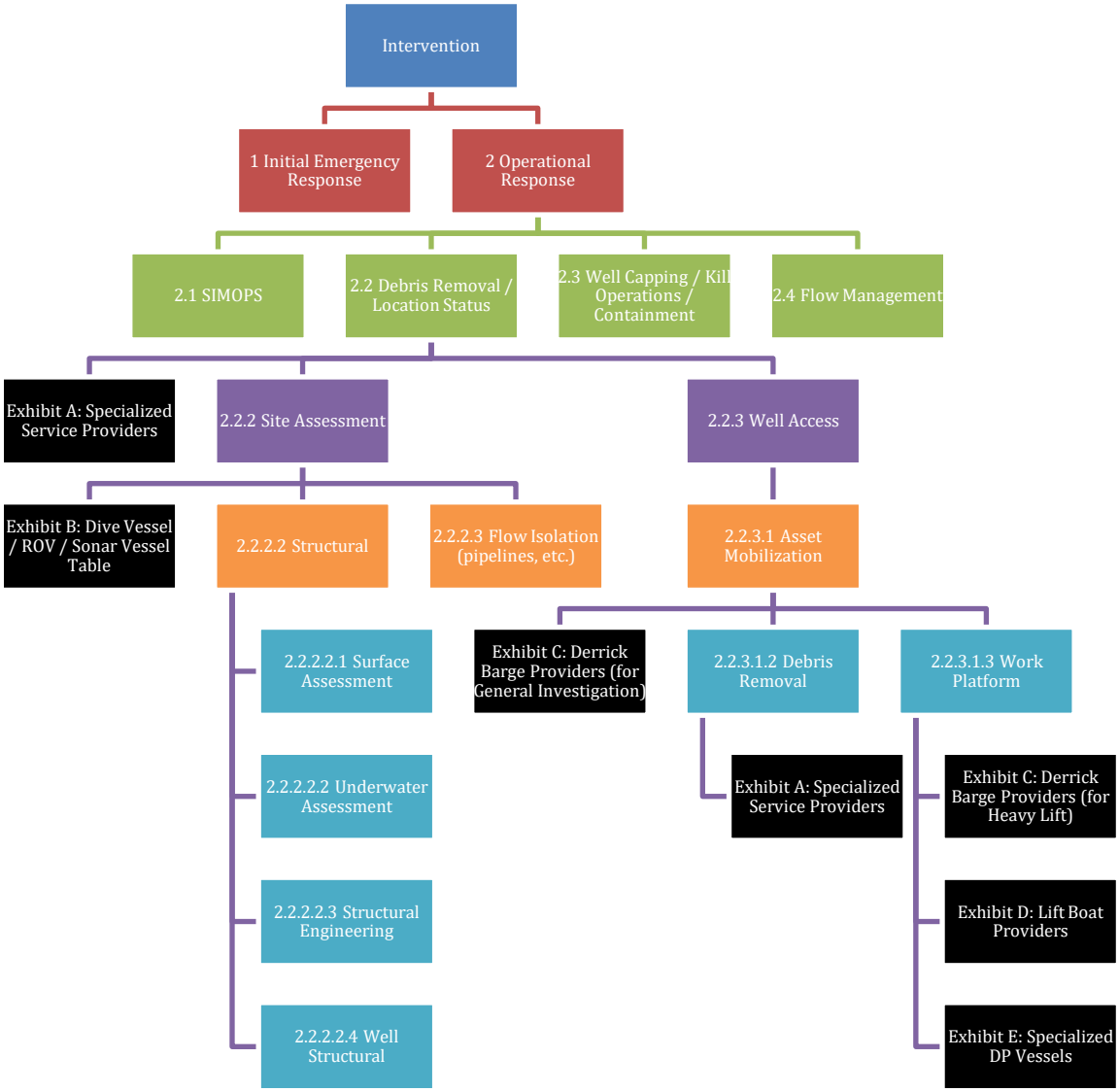
Refers to incident specific communications between the SIMOPS team and the emergency management team i.e. dedicated email systems, phone systems (protocols for answering questions, etc.).

2.1.3.3 Field Communications

Refers to common communications and documentation to help ensure all field operations are utilizing the same information in a consistent manner.

2.2 Debris Removal / Location Status

A well control event sometimes damages production and/or rig equipment preventing access to the wellbore or leak path. Debris removal may be required to provide access to a flange, the wellbore, or a leak point in the wellbore in preparation for future containment, kill, or capping well control operations. The following diagram outlines the general considerations within this subsection.



2.2.1 Specialized Service Providers

A collection of specialized service providers is maintained on the OOC SWSC website as, **"Exhibit A: Specialized Service Providers"**.

2.2.2 Site Assessment

Refers to the process of collecting data from the damaged well control event area, wellbore, supporting structure, and associated pipelines. The assessment might include gathering data using divers, ROV's, sonar, video and other techniques to model the worksite and debris field. These models are used to evaluate the feasibility of debris removal, analyze structural integrity, and risk assess future well control operations.

2.2.2.1 Dive Vessel / ROV / Sonar Vessel Tables

A collection of dive vessel, ROV and sonar vessel providers is maintained on the OOC SWSC website as, **"Exhibit B: Dive Vessel, ROV and Sonar Vessel Providers"**.

2.2.2.2 Structural

The structural part of the site assessment includes assessing the surface equipment, subsea equipment, and wellbore for structural integrity. A structural engineering study is completed to evaluate the integrity of the remaining structure and wellbore to ultimately provide assurance that planned debris removal, and well control operations can be implemented without harm to people or the environment.

2.2.2.2.1 Surface Assessment

The surface assessment consists of evaluating the condition of the associated platform, wellbore and production equipment above the water line. The plan should include defining resources necessary to perform surface assessment including re-boarding, Emergency Egress Plans and Detailed Site Survey.

2.2.2.2.2 Underwater Assessment

Refers to evaluating the condition of the platform and wellbore below the water line. ROV's, divers, cameras, magnetometers and specialized sonar equipment can be used to develop a model showing the location and condition of the equipment below the water line.

2.2.2.2.3 Structural Engineering

The surface and underwater assessments are used to construct a structural engineering study of the damaged platform/equipment. The Engineering study is then used to develop the debris removal plan and to conduct HSE risk analysis for boarding and working on the platform. Specialized engineering companies can be used to provide expertise in developing the structural engineering analysis.

2.2.2.2.4 Well Structural

The well structural assessment and engineering study assists in defining the intersection point and kill plan. Specialized engineering companies can be used to provide expertise in developing the structural engineering analysis.

2.2.2.3 Flow Isolation (pipelines, etc.)

The flow isolation study will provide assurance that the appropriate pipelines are shut-in following a well control event. This may require notification to third party operators (pipelines).

2.2.3 Well Access

Refers to providing an access point (i.e. flange, casing, or a leak point) for containment, kill, or capping well control operations.

2.2.3.1 Asset Mobilization

A work platform usually consisting of a derrick barge and/or lift boat along with dive, ROV, intervention, and supply vessels will be mobilized to the well control site as required for debris removal. The number, size, and type of vessels mobilized will depend on the particular well control event, water depth, SIMOPS, and weather.

2.2.3.1.1 Derrick Barge Asset Table for General Investigation

A collection of derrick barge providers is maintained on the OOC SWSC website as, **"Exhibit C: Derrick Barge Providers"**.

2.2.3.1.2 Debris Removal

Refers to the process of removing damaged equipment from around a wellbore to provide well access in preparation for future well control operations. Specialized equipment and services may be required for Debris Removal. These specialized services may include, but are not limited to, the following types of equipment:

- Abrasive Jet Cutters
- Freeze Equipment
- Diamond Wire Saw
- Port-a-Lathe
- Vertical Rail Cutters
- Clam Shell Cutters
- Frog Cutters
- Hot Tapping

2.2.3.1.2.1 Specialized Equipment Service Providers

A collection of Specialized Equipment Services is maintained on the OOC SWSC website as, **"Exhibit A: Specialized Equipment Service Providers"**.

2.2.3.1.3 Work Platform

A work platform usually consists of a derrick barge, lift boat and/or specialty DP vessels. The work platform can be used for site access operations to include: debris removal equipment, lifting requirements, equipment storage, and house people. Note: A collection of derrick barge and lift boat providers is maintained on the OOC SWSC website as, **"Exhibit C: Derrick Barge Providers"** and **"Exhibit D: Lift Boat Providers"** and **"Exhibit E: Specialty DP Vessels"**.

2.2.3.1.3.1 Lift Boat Table

A collection lift boat providers is maintained on the OOC SWSC website as, **"Exhibit D: Lift Boat Providers"**.

2.2.3.1.3.2 Derrick Barge Providers for Heavy Lift

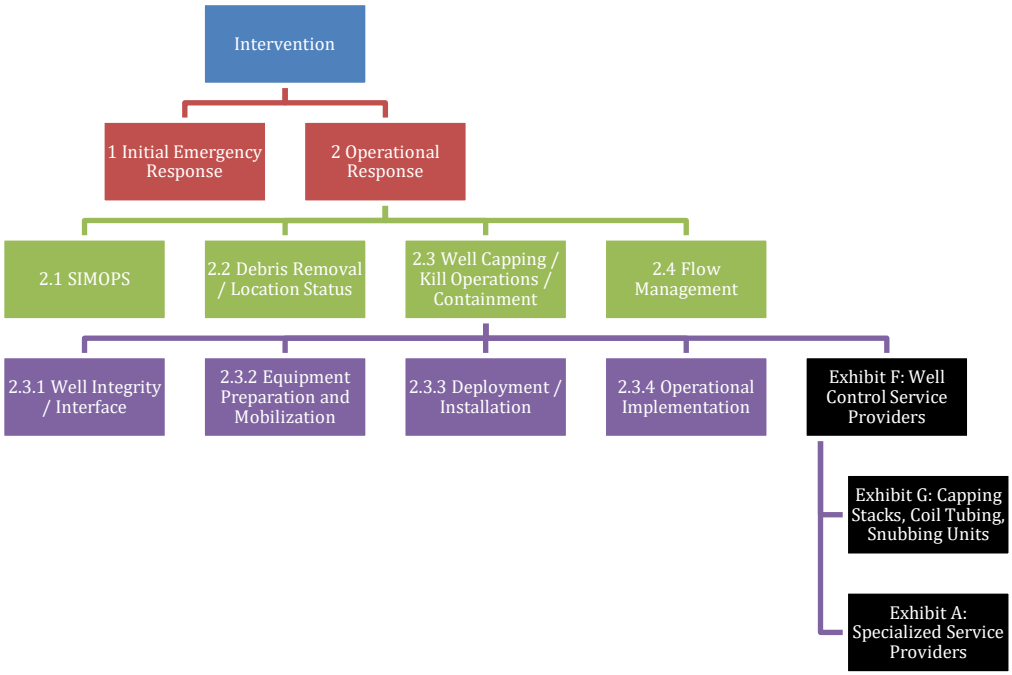
A collection of derrick barge providers is maintained on the OOC SWSC website as, **"Exhibit C: Derrick Barge Providers"**.

2.2.3.1.2.1 Specialized Dynamic Positioned Vessel Table

A collection of specialized DP vessels is maintained on the OOC SWSC website as, **"Exhibit E: Specialty DP Vessels"**.

2.3 Well Capping / Kill Operations / Containment

The following diagram outlines the general considerations included within this subsection.



2.3.1 Well Integrity / Interface

Refers to the assessment of the current well condition and predicted future degradation. Utilizing the well integrity to prepare for and determine the feasibility of kill, capping, and cap & flow operations. (Flow and shut-in pressure profile of the incident well to be determined by the flow management group.)

2.3.2 Equipment Preparation and Mobilization

Refers to the sourcing, sizing and preparation of intervention equipment, mobilization to shore base, testing and mobilization to site.

2.3.3 Deployment / Installation

Refers to the mobilization and rig-up of the intervention equipment to the source. This activity includes the orchestration of the required field assets (derrick barges, coil tubing, snubbing unit, capping stack, etc.) to accomplish connection.

2.3.4 Operational Implementation

Refers to the execution sequencing of the selected source control intervention method.

2.3.5 Well Control Service Providers

A collection of well control service providers is maintained on the OOC SWSC website as **“Exhibit F: Well Control Service Providers”**.

2.3.5.1 Capping Stacks, Coil Tubing, Snubbing Units

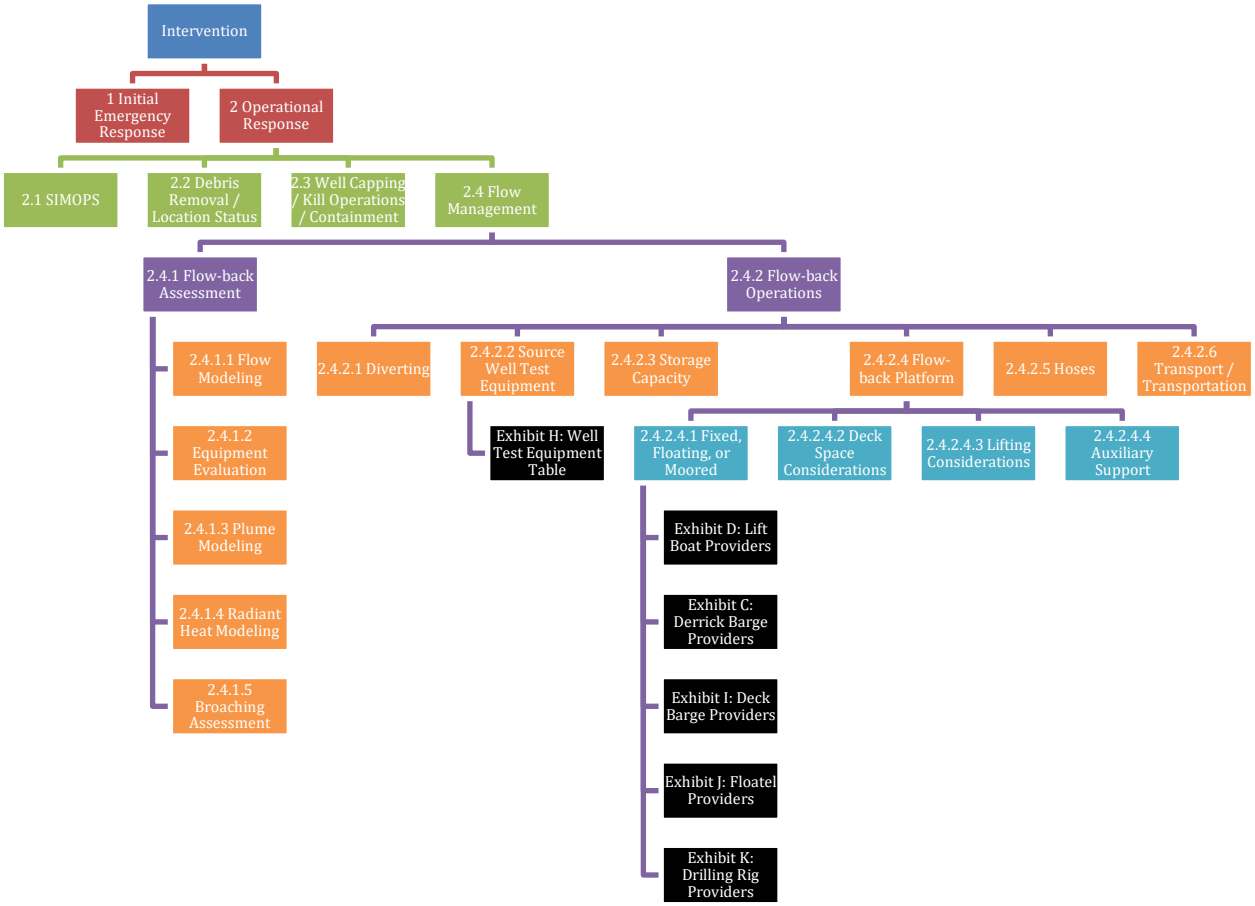
A collection of capping stacks, coil tubing, and snubbing unit providers is maintained on the OOC SWSC website as, **"Exhibit G: Capping Stacks, Coil Tubing, and Snubbing Unit Providers"**.

2.3.5.2 Specialized Service Providers

A collection of specialized service providers is maintained on the OOC SWSC website as, **"Exhibit A: Specialized Service Providers"**.

2.4 Flow Management

The following diagram outlines the general considerations included within this subsection.



2.4.1 Flow-back Assessment

All processes necessary to model and plan flow from surface, subsurface and seafloor. This evaluation includes flow-back considerations through the proposed surface equipment.

2.4.1.1 Flow Modeling

Refers to the computer modeling required to predict an estimate of the discharging fluids, as well as static and dynamic conditions. The model estimate will assist in sizing the appropriate flow-back equipment and required barge capacity.

2.4.1.2 Equipment Evaluation

Refers to the iterative analysis to define equipment required for safe and sustained flow and/or dynamic kill.

2.4.1.3 Plume Modeling

Refers to ventilation and hydrocarbon dispersion needed to assist in the positioning of assets for well intervention and flow management.

2.4.1.4 Radiant Heat Modeling

Refers to heat modeling to assist in the positioning of assets for well intervention and flow management.

2.4.1.5 Broaching Assessment

Refers to broaching modeling and geologic review needed to define parameters which may contribute to a seafloor broach for flow management.

2.4.2 Flow-Back Operations

Flow-back assessment requires the identification of appropriate assets. The following subsections outline the considerations for flow-back operations.

2.4.2.1 Diverting

Diverting integrates all of the equipment necessary to divert flow overboard (or to a processing platform) without interruption while intervening on the discharging well and/or drilling a relief well.

2.4.2.2 Source Well Test Equipment

Refers to the sizing and sourcing of portable well test equipment designed to process discharging fluids. Processing should include the capability of discharging formation waters, capturing hydrocarbons (for disposal and/or reclamation) and flaring of gas.

2.4.2.2.1 Well Test Equipment

A collection of well test equipment providers is maintained on the OOC SWSC website as, **"Exhibit H: Well Test Equipment Providers"**.

2.4.2.3 Storage Capacity

Refers to the vessels with their respective capacities available to capture produced fluid on site and with the ability to transport these fluids to a disposal/reclamation site.

2.4.2.4 Flow-back Platform

Refers to a vessel or group of vessels capable of either being moored or fixed on a cleared location offset to the discharging well.

2.4.2.4.1 Fixed, Floating, or Moored

The additional vessels and work platforms needed in the execution of the response will need to take into consideration at a minimum the water depth, site conditions and infrastructure. These considerations may limit the viable station keeping categories of vessels as fixed, floating or moored.

2.4.2.4.1.1 Lift Boat Providers

A collection of lift boat providers is maintained on the OOC SWSC website as, **"Exhibit D: Lift Boat Providers"**.

2.4.2.4.1.2 Derrick Barge Providers

A collection of derrick barge providers is maintained on the OOC SWSC website as, **"Exhibit C: Derrick Barge Providers"**.

2.4.2.4.1.3 Deck Barge Providers

A collection of deck barge providers is maintained on the OOC SWSC website as, **"Exhibit I: Deck Barge Providers"**.

2.4.2.4.1.4 Floatel Providers

A collection of floatel providers is maintained on the OOC SWSC website as, **"Exhibit J: Floatel Providers"**.

2.4.2.4.1.5 Drilling Rig Providers

A collection of jack-up providers and large deck space vessel providers are maintained on the OOC SWSC website as, **"Exhibit K: Drilling Rig Providers"**.

2.4.2.4.2 Deck Space Considerations

Refers to sizing the flow-back platform vessel appropriately to accept the well test equipment layout with consideration for additional services.

2.4.2.4.3 Lifting Considerations

Refers to identifying lifting requirements for operating the flow-back equipment. The flow-back platform should contain a crane for equipment management and may require the installation of a portable crane on vessels such as a flow-back barge.

2.4.2.4.4 Auxiliary Support

Refers to identifying capabilities of the flow-back platform in addition to managing the flow-back process. Living quarter capacity, ROV and diving support, communications outpost are several considerations when selecting the appropriate platform.

2.4.2.5 Hoses

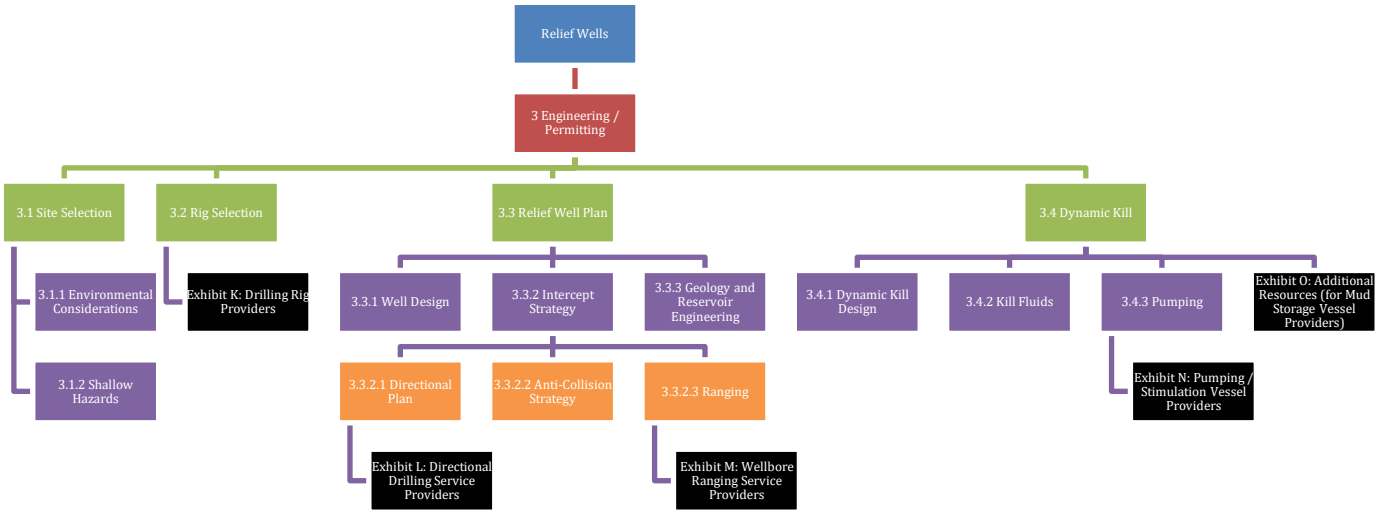
Refers to the sizing and sourcing of subsea armored and flexible hoses required to divert produced fluids from the discharging well to the flow-back platform and subsequently onto the hydrocarbon retention vessel/barge. Refers to the integration of floatation equipment necessary to deploy the hoses between vessels.

2.4.2.6 Transport / Transportation

Refers to the vessels/barges approved for hydrocarbon collection and transport from well site to a disposal and/or reclamation facility. Vessel capacities are evaluated for flow duration with operational capability of vessel rotation without interruption of the flow process. Refers to tugs services required to tender the barges on location and tow the vessels to the disposal/reclamation facility.

Relief Wells

The long-term answer to a well control event may include execution of a relief well to permanently secure the discharging source well. This section outlines the general considerations for timely execution of a relief well or wells.



3 Engineering / Permitting

In-house and/or contract service engineering will design the relief well and complete permitting requirements. Engineering will assemble an operation plan, mobilize an available rig and coordinate relief well efforts upon receiving approval from the BSEE.

3.1 Site Selection

Planning engineers working with geological staff to confirm a safe and cleared surface location for placement of the relief rig. Directional planning will be taken into consideration when selecting site (section 3.3.2.1).

3.1.1 Environmental Considerations

The assessment of metocean and weather to optimize correct positioning of assets to maximize operational efforts to intervene on the discharging source with the minimum disruption due to changing weather patterns.

3.1.2 Shallow Hazards

Planning engineers working to confirm a safe and cleared surface location for placement of the relief rig.

3.2 Rig Selection

Team analysis of individual requirements for rig selection including water depth, mud penetration, mud and cement capacities, casing capacities, hole size, top drive, cranes, availability, etc.

3.2.1 Drilling Rig Table

A collection of drilling rig providers is maintained on the OOC SWSC website as, **"Exhibit K: Drilling Rig Providers"**.

3.3 Relief Well Plan

Engineering will develop integrated Relief Well Plan which can be used to successfully drill, intercept, and kill the target well.

3.3.1 Well Design

Engineering will design for the appropriate casing size to successfully intercept the discharging well, providing for the contingencies due to unforeseeable drilling problems. In addition, the casing size must be designed for performing dynamic kill operations.

3.3.2 Intercept Strategy

Coordination between engineering, directional drilling and ranging services to design the optimum intercept solution for assurance of a dynamic kill opportunity.

3.3.2.1 Directional Plan

The well path solution that optimally intercepts the target intercept point.

3.3.2.1.1 Directional Drilling Service Providers

A collection of directional drilling service providers is maintained on the OOC SWSC website as **"Exhibit L: Directional Drilling Service Providers"**.

3.3.2.2 Anti-Collision Strategy

Engineering will define an appropriate strategy to provide suitable target well intersections without encountering a premature intersection of surrounding wells.

3.3.2.3 Ranging

Ranging will involve the strategy and equipment required to locate and intercept the subject wellbore in order to secure it underground.

3.3.2.3.1 Ranging Service Providers

A collection of ranging service providers is maintained on the OOC SWSC website as, **"Exhibit M: Wellbore Ranging Service Providers"**.

3.3.3 Geology and Reservoir Engineering

Geological and reservoir engineering staffs will review formation and pore pressure information for relief well planning. Shallow hazards review team, which includes geological and third party hazard survey specialists, to confirm seafloor integrity for well and rig placement.

3.4 Dynamic Kill

Includes dynamic kill calculations, design and equipment requirements. These can be assembled by the Operator's preferred well intervention service provider and/or consultant engineering firms. The dynamic kill design will be integrated into relief well drilling operations for compatibility with the casing design and rig capability.

3.4.1 Dynamic Kill Design

Design includes the dynamic kill model integrated with fluid selection, piping size, and deliverability.

3.4.2 Kill Fluids

This includes considerations for fluid type, volumes and required densities of kill fluids. Storage considerations must account for required volumes.

3.4.3 Pumping

This includes considerations for equipment requirements to achieve the kill operation.

3.4.3.1 Pumping/Stimulation Vessel Providers

A collection of pumping/stimulation vessel providers is maintained on the OOC SWSC website as, **"Exhibit N: Pumping/Stimulation Vessel Providers"**.

3.4.4 Mud Storage Vessel Providers

A collection of mud storage vessel providers is maintained on the OOC SWSC website as, **"Exhibit O: Additional Resources"**.