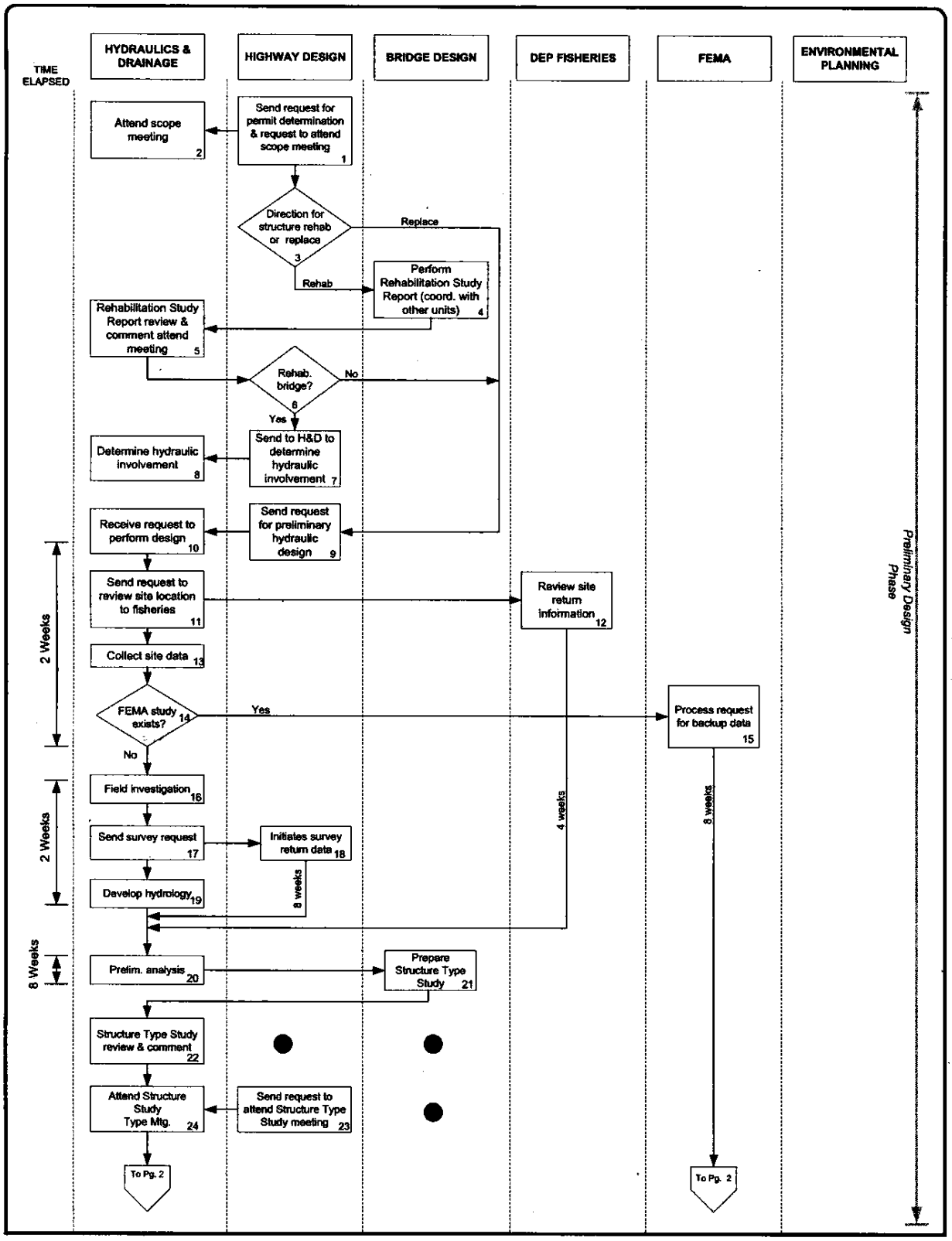
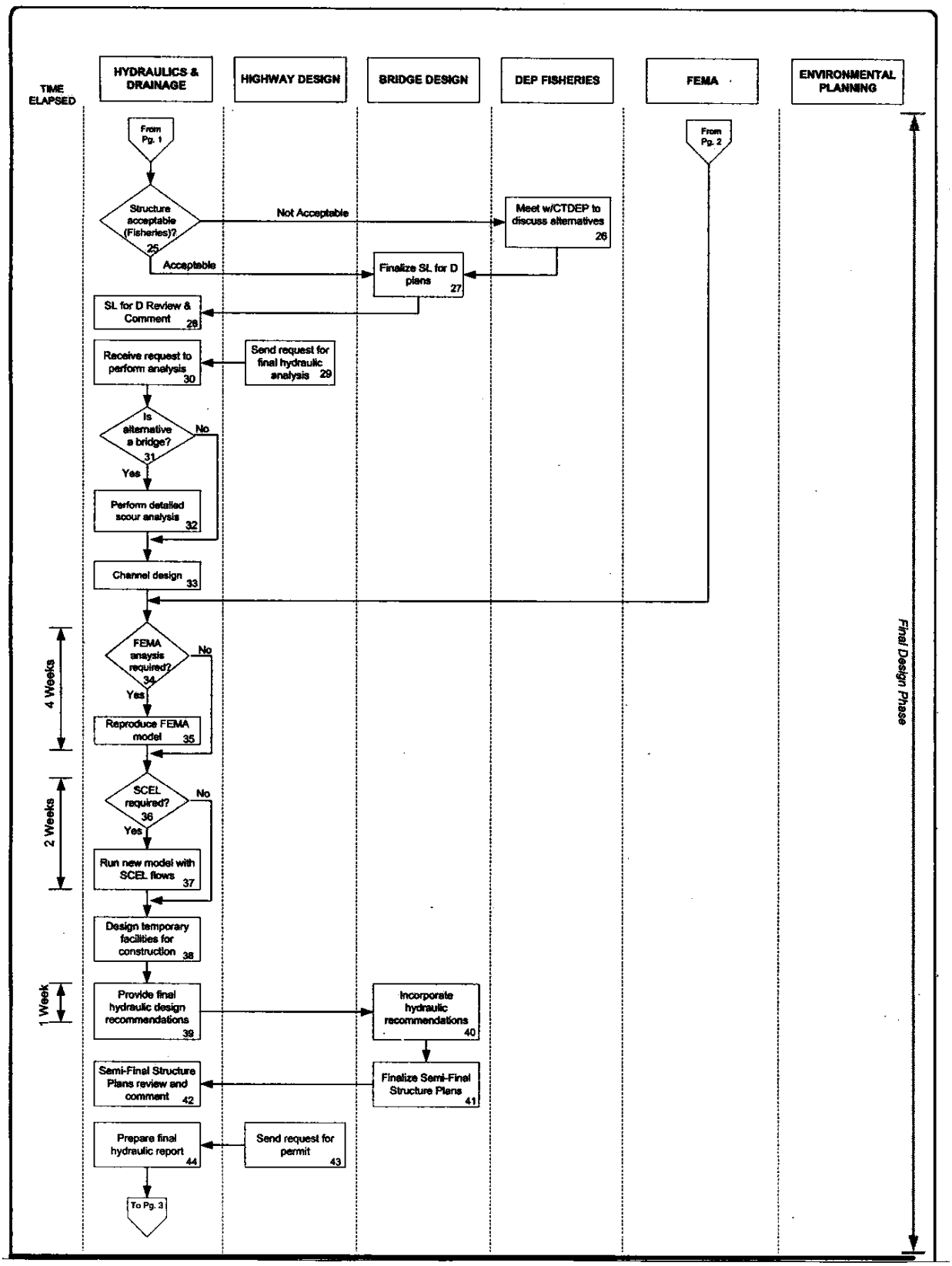
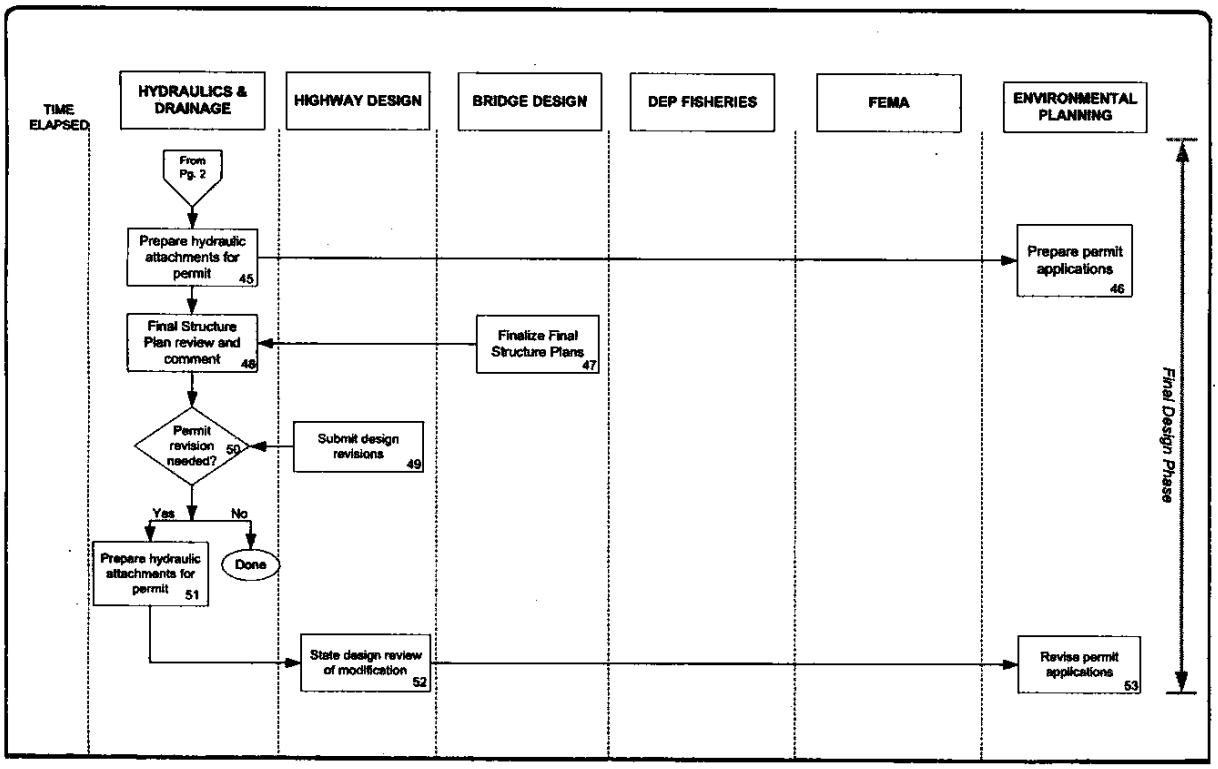
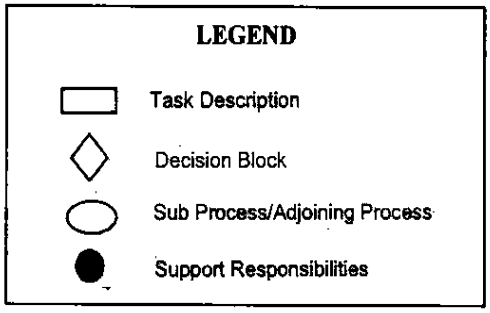
Appendix C – In-House Development of Hydraulic Requirements for Crossings Conveying a Waterway Greater Than 2.59 km^2 (1 mi^2)




TIME ELAPSED
HYDRAULICS & DRAINAGE
HIGHWAY DESIGN
BRIDGE DESIGN
DEP FISHERIES
FEMA
ENVIRONMENTAL PLANNING
From Pg. 1
Structure acceptable (Fisheries)? 25
Not Acceptable
Meet w/CTDEP to discuss alternatives 26
Acceptable
Finalize SL for D plans 27
SL for D Review & Comment 28
Receive request to perform analysis 30
Send request for final hydraulic analysis 29
Is alternative a bridge? 31
No
Yes
Perform detailed scour analysis 32
Channel design 33
From Pg. 2
FEMA anaysis required? 34
No
Yes
Reproduce FEMA model 35
SCEL required? 36
No
Yes
Run new model with SCEL flows 37
Design temporary facilities for construction 38
Provide final hydraulic design recommendations 39
Incorporate hydraulic recommendations 40
Finalize Semi-Final Structure Plans 41
Semi-Final Structure Plans review and comment 42
Prepare final hydraulic report 44
Send request for permit 43
To Pg. 3
4 Weeks
2 Weeks
1 Week
Final Design Phase


TIME ELAPSED
HYDRAULICS & DRAINAGE
HIGHWAY DESIGN
BRIDGE DESIGN
DEP FISHERIES
FEMA
ENVIRONMENTAL PLANNING
From Pg. 2
Prepare hydraulic attachments for permit 45
Prepare permit applications 46
Final Structure Plan review and comment 48
Finalize Final Structure Plans 47
Permit revision needed? 50
Submit design revisions 49
Yes
No
Prepare hydraulic attachments for permit 51
Done
State design review of modification 52
Revise permit applications 53
Final Design Phase


LEGEND
Task Description
Decision Block
Sub Process/Adjoining Process
Support Responsibilities

Box #	Task Name	Owner	Duration	Description
1	Request permit determination and request H&D to attend scoping meeting	Highway Design	1 day	Highway design sends permit determination request to H&D and requests that H&D attend scoping meeting.
2	Attend scoping meeting	Engineer	1 day	H&D attends scoping meeting with other units at request of Highway design to discuss project issues and direction of structure rehab or replacement.
3	Determine if structure is rehab or replacement	Highway Design	1 wk	Highway Design will determine if structure will be rehab or replacement.
4	Rehabilitation Study Report	Bridge Design	4 wks	Prepare Rehabilitation Study Report. Coordinate and obtain information from other units as necessary.
5	Review and comment on rehabilitation study report	Engineer	1 wk	Provide written comments on rehabilitation report and attend review meeting.
6	Determine if structure can be rehabilitated	Highway Design	1 day	After completion of rehabilitation study, Highway Design will determine if structure can be rehabilitated.
7	Request H&D involvement	Highway Design	1 day	Highway design will send written request to H&D to determine the hydraulic involvement for the rehab project.
8	Determine hydraulic involvement	Engineer	1 wk	H&D will determine the extent of H&D's involvement for the structure rehabilitation.
9	Request preliminary hydraulic design	Highway Design	1 day	Highway Design sends request to perform preliminary hydraulic design to H&D.
10	Project initiation	Section Head	1 day	Receive request for preliminary hydraulic design from Highway Design. Review request, information, schedule, funds, and assign to Engineer.
11	Request DEP Fisheries review	Engineer	1 day	Send request letter to DEP Fisheries to review site location.
12	Site review	DEP Fisheries	4 wks	Perform site review and return any special requirements to H&D.

Box #	Task Name	Owner	Duration	Description
13	Collect site data	Engineer	15 day	Collect existing data from H&D: FEMA, H&D files, River Study, Scour, USGS, SCEL. BS&E: Bridge inspection reports, underwater reports. ER&R: project plans and as-built. Soils & Foundations: search folders by town. Contact: Towns, Maintenance (District Office or Town), Environmental Planning, Central Surveys, DEP, USDA Natural Resource Conservation Service, USGS.
14	FEMA study?	Engineer	1 day	If a detailed FEMA study exists for the site, request backup data from FEMA with a prepaid vendor form.
15	FEMA process	FEMA	8wks	Assemble and return detailed FEMA backup data to H&D.
16	Field investigation	Engineer	1 day	Perform field visit. Send notification to and invite other disciplines. Complete field review form and identify survey requirements.
17	Survey request	Engineer	1 day	Prepare a request for hydraulic survey and send to Highway Design.
18	Initiate survey	Highway Design	8wks	Highway Design will initiate the survey and return the completed plans and cross-sections to H&D.
19	Develop hydrology	Engineer	1wk	Develop flows using information available.
20	Preliminary analysis	Engineer	8wks	Review information from Fisheries, Survey, and FEMA. Work with Bridge Design on types of structures to be studied. Perform preliminary analysis of alternative structures, including a qualitative scour evaluation and prepare data for the Structure Type Study. Forward data to Bridge Design.
21	Structure Type Study	Bridge Design	3wks	Bridge Design will prepare a Structure Type Study and send a copy to H&D for review and comment.
22	Review and comment on structure type study	Engineer	1wk	Prepare written comments on Structure Type Study and return to Highway Design.
23	Send request to attend structure type study meeting	Highway Design	1 day	Highway Design will request H&D to attend the Structure Type Study Meeting.
24	Attend structure type study meeting	Engineer	1 day	Attend Structure Type Study Meeting with other sections for structure selection.

Box #	Task Name	Owner	Duration	Description
25	Review structure acceptability to DEP Fisheries	Engineer	1 day	Investigate if selected structure is consistent with previous letter of recommendation from DEP Fisheries.
26	Meet with DEP Fisheries to discuss alternatives	Highway Design, DEP Fisheries and Engineer	1wk	If selected structure is not consistent with DEP Fisheries recommendation then Highway Design will meet with DEP Fisheries and discuss mitigation measures or alternatives. May have to coordinate with H&D and make a presentation to Fisheries with the most reasonably solution.
27	Finalize SLD plans	Bridge Design	8 wks	Bridge Design prepares SLD plans for the culvert/bridge including stage construction and water handling concepts and sends them to other units for review. Structure design is 30% complete.
28	Review and comment on SLD plans	Engineer	1 wk	Prepare written comments on the SLD plans and return to Bridge Design.
29	Final structure selected	Highway Design	1 day	Highway Design will send letter to H&D requesting they proceed with final design of selected alternative. Submission should include plan, profiles, cross sections, and available bridge plans.
30	Project advancement	Section Head	1day	Received request to advance project to final design.
31	Is alternative a bridge?	Engineer	1 day	If alternative is a bridge then H&D will conduct a Detailed Scour Evaluation early in Final Design for use in foundation design.
32	Scour analysis	Engineer	1 wk	Prepare detailed scour analysis and forward results to Highway Design, Bridge Design and Soils and Foundations.
33	Channel design	Engineer	2 wks	If channel protection or restoration is required, perform design and develop plans.
34	Detailed FEMA study required?	Engineer	1 month+	Was a detailed FEMA study performed?
35	FEMA model	Engineer	4 wks	Recreate FEMA model using FEMA backup information. Compare flood elevations to the original FEMA flood elevations. Impose proposed condition and re-run model. No increase in encroached condition flood elevation is allowed. If there is an increase in flood elevation, change model to increase conveyance, compensate for increased flood by increasing storage, or process request for map revision. (A map revision can take a year or more).

Box #	Task Name	Owner	Duration	Description
36	Do SCEL exist within the project area?	Engineer	1 day	If Stream Channel Encroachment Lines analysis data exists and the discharge varies from the FEMA values, run another model.
37	SCEL model	Engineer	2 wks	Re-run the existing and proposed model using the flows from the SCEL report to show the change in flood elevations.
38	Design temporary facilities	Engineer	1 wk	Run models for all stages of construction. Work with Highway Design to develop a workable construction sequence and size temporary work. Time varies depending on complexity of construction.
39	Final hydraulic design recommendations	Engineer	1 wk	H&D to provide final hydraulic design recommendations to Bridge Design.
40	Incorporate hydraulic recommendations	Bridge Design	1 wk	Bridge Design incorporates final hydraulic design recommendations in structure design.
41	Finalize semi-final design	Bridge Design	1 wk	Bridge Design prepares semi-final plans for the culvert/bridge and sends them to other units for review. Structure design is 90% complete.
42	Review and comment on semi-final plans	Engineer	1 wk	Prepare written comments on the semi-final plans and return to Highway Design.
43	Request permit	Highway Design	1 wk	Highway Design will request H&D to prepare permits.
44	Prepare final hydraulic report	Engineer	2 wks	Prepare final hydraulic report including scour, design, FEMA, SCEL.
45	Permit hydraulics attachments	Engineer	1 wk	Prepare and assemble attachments and supporting documentation for permit application. Which could include attachment A-1, attachment H Part 1 and Part 2. Forward to Highway Design who will complete permit application and forward to Environmental Planning.
46	Permit application	Environmental Planning	2 wks	Environmental Planning will finalize and submit the permit applications to Connecticut DEP. Connecticut DEP approval usually takes 6-12 months.
47	Finalize structure plans	Bridge Design	8 wks	Bridge Design prepares final plans for the culvert/bridge and sends them to other units for review. Structure design is 100% complete.
48	Review and comment on final structure plans	Engineer	1 day	Review final structure plans to assure they are consistent with hydraulic design and the permits.
49	Project revision	Highway Design	Varies	If Highway Design changes any aspect of the project that has any relation to the hydraulic aspects, they must forward changes to H&D.

Box #	Task Name	Owner	Duration	Description
50	Permit revision needed?	Engineer	Varies	H&D will review the revision, re-run the hydraulic models, if necessary, and determine if a revision to the permit is needed.
51A	No permit revision	Engineer	1 day	If no revision is needed, send letter to Highway Design.
51	Permit revision	Engineer	1 wk	If a revision to the permit is needed, prepare the hydraulic portion of the revision to the permit and submit to Highway Design
52	Review of modification	Highway Design	1 wk	Highway Design reviews modification made by H&D and determines whether to amend the permit or prepare a technical revision. Highway Design then prepares the full application and forwards to Environmental Planning.
53	Revise permit applications	Environmental Planning	1 wk	Environmental Planning reviews permit revision and submits to ConnDEP.