QUESTIONS ON JANUARY 2011 DRAFT BAS SYNTHESIS

CHAPTER 3 MARINE FISH AND WILDLIFE HABITAT CONSERVATION AREAS

1. Section 1.9, Page 22, paragraph 2: How do human actions affect the conflicting requirements of “low wave action” needed for healthy eelgrass and “more wave action” needed for giant kelp to obtain nutrients? How does this apply to the BAS synthesis?

2. Please provide a definition and references for non-standard terms used in the Draft Synthesis. For example, what criteria must a “bluff” meet in order to be categorized as a “feeder bluff”? Are the classification criteria quantitative?

TWC: Needs direction as to which terms need defining. This could be provided during the revisions to regulations.

3. My questions for the experts are, "Do technological systems exist that can capture and treat the runoff from a residential development that is located, according to the property owners choice, at any distance from a critical area, such as the shoreline?"

"Secondly, what type and frequency of monitoring would be appropriate?"

"And lastly, what would be the ballpark cost of installing, maintaining, and monitoring such a system per 1000 square feet of development?"

PS Portions of the two attached scholarly articles are pasted at the bottom of this email.

PPS These questions are posed in the following context:

The County Councilors are considering two proposed concurrent options for the Critical Area Ordinance Update buffer regulations:

A fixed buffer setback of 150 feet or 200 feet or

A variable buffer setback, chosen by the property owner, but with a stormwater handling facility. Maintenance of the stormwater collection and release facility and monitoring of the runoff would be financed by an escrow account established by the property owner.

I have several questions about the second option. The County Councilors do not seem to understand that capture of stormwater in a trench or pit followed by the water’s controlled release to a rocky substrate or a steep vegetated slope will not adequately treat any toxic chemicals that are transported along with the stormwater. Stormwater infiltration of vegetated soil is required for the capture and biodegradation of toxic chemicals such as the surfactants and pesticides that are used to treat and prevent termites and carpenter ant infestations of homes. Four pesticide treatments per year are the norm for homes serviced by San Juan Pest Control. Once an infestation has occurred, homeowners who can afford the bill seem to accept this quarterly application of pesticide and surfactant around the foundation perimeter indefinitely. These chemicals will be carried downhill by stormwater, and if not intercepted in an appropriately-sized vegetated buffer, will end up in our waters.

Also, the design of stormwater handling facilities probably does not include the capacity for intense rainstorms. These are the primary events that carry toxic chemicals and silt downhill and into our waters.

Aquatic Toxicity Due to Residential
Use of Pyrethroid Insecticides
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Pyrethroids are the active ingredients in most insecticides available to consumers for residential use in the United States. Yet despite their dominance in the marketplace, there has been no attempt to analyze for most of these compounds in watercourses draining residential areas. Roseville, California was selected as a typical suburban development, and several creeks that drain subdivisions of single-family homes were examined. Nearly all creek sediments collected caused toxicity in laboratory exposures to an aquatic species, the amphipod Hyalella azteca, and about half the samples caused nearly complete mortality. This same species was also found as a resident in the system, but its presence was limited to areas where residential influence was least. The pyrethroid bifenthrin is implicated as the primary cause of the toxicity, with additional contributions to toxicity from the pyrethroids cyfluthrin and cypermethrin. The dominant sources of these pyrethroids are structural pest control by professional applicators and/ or homeowner use of insecticides, particularly lawn care products. The suburbs of Roseville are unlikely to be unique, and similar sediment quality degradation is likely in other suburban areas, particularly in dry regions where landscape irrigation can dominate seasonal flow in some water bodies.

Advances in Pesticide Environmental Fate and Exposure Assessments

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Globalization of markets and the growing world population increase threats of invasive and exotic species and place greater demands on food and fiber production. Pest management in both agricultural and nonagricultural settings employs established practices and new biological, chemical, and management technologies. Pesticides are an essential tool in integrated pest management. Without pesticides a significant percentage of food and fiber crops would be lost, infectious diseases would increase, and valuable native habitats would be devastated. Therefore, it is important to understand the environmental fate of pesticides and assess their potential exposure and associated risks to human health and the environment. This paper summarizes the Advances in Pesticide Environmental Fate and Exposure Assessment symposium held at the 231st National Meeting of the American Chemical Society (Atlanta, GA, 2006). The focus of the symposium was to provide current information on advances in pesticide environmental fate and exposure assessments. Thirty papers were presented on advances ranging from subcellular processes to watershed-scale studies on topics including chemical degradation, sorption, and transport; improved methodologies; use of modeling and predictive tools; exposure assessment; and treatment and remediation. This information is necessary to develop more effective pesticide use and management practices, to better understand pesticide fate and

associated exposures and risks, to develop mitigation and remediation strategies, and to establish sound science-based regulations.
KEYWORDS: Pesticide; degradation; catabolism; sorption; transport; runoff; modeling; predictive tools; exposure assessment; treatment; remediation

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PESTICIDE TRANSPORT WITH RUNOFF
From page 5370 of Rice et al. (Complete article is attached as a .pdf)

Chemical pollutants, including pesticides, have been detected in the surface waters of urban and agricultural areas (9, 10, 57). A number of these compounds have been shown to reduce water quality and result in adverse effects to sensitive organisms, aquatic ecosystems, and human health, depending on their concentration and duration of exposure (13-15, 58, 59). Pesticides can be displaced from their site of application to nontarget surface waters via spray drift, volatilization, and transport with water. A greater understanding of pesticide transport with runoff and leachate, factors that influence runoff and associated pesticide loads, and evaluation of remediation strategies to reduce pesticide loads with runoff were discussed.

Runoff. The potential for pesticides to be transported with surface runoff have been evaluated with natural rainfall, simulated rainfall/irrigation, and computer model simulations in both agricultural and nonagricultural settings (60-64). In most simulated-rainfall studies precipitation is produced at a constant intensity or fixed rainfall rate, which is atypical of natural storm events demonstrating large with-in storm variations. To determine the impact of variable and constant rainfall intensities on the transport of herbicides with surface runoff, studies were initiated to quantify loads of two herbicides (fluometuron, pendimethalin) with runoff as influenced by rainfall intensity (constant or variable rainfall) and tillage practices (strip or conventional tillage). Variable rainfall intensity produced greater runoff rates of both herbicides from plots under conventional tillage, whereas no significant difference in herbicide runoff rates was observed between variable or constant rainfall intensity patterns from strip tillage plots. Results of this study suggest use of variable intensity rainfall patterns that simulate characteristics of natural rainfall can improve rainfall simulation-based estimates of pesticide runoff (65).

4. Page 5. The Draft Synthesis reports priority ecological attributes identified by the San Juan County Marine Resources Committee (MRC). Is it the assertion of the authors that MRC statements represent BAS? If so, on what basis?

5. Page 5. Why is the reference "(Evans and Kennedy 2007)" at page 5 not included in the Literature Cited section of the chapter? Please identify that reference so that the public will have an opportunity to identify and review it.

Reference was included in original draft.

6. Page 7. The Draft Synthesis states that "any human-induced alteration of a shoreline's wave characteristics could potentially affect the way sediment is transported along the shoreline." What Is the authority for this proposition? Is it peer-reviewed? The Draft Synthesis states "potentially," but is there any actual evidence that this is occurring in San Juan County?

7. Page 8. What is the scientific basis for the statement that available data and maps "often do not include the complete distribution or specific locations of each species or habitat requiring protection"?

8. Page 8. Does the statement that available data and maps "often do not include the complete distribution or specific locations of each species or habitat requiring protection" mean that these habitat areas are not actually as limited as these references may make it appear?

9. Page 8. What does the statement that "Effective protection depends on requiring site-specific project planning based on valued resources as part of permitting development activities" mean? What authority is there for this proposition? It is peer-reviewed?

10. Page 8. Who is J. Kerwin? What are his qualifications to make the determination cited, and where is his CV available for review by the public?

Author of Salmon and Steelhead Habitat Limiting Factors Report for the San Juan Islands (Water Resource Inventory Area 2), produced by the Washington Conservation Commission.

11. Page 8. Is it asserted that the Puget Sound Salmon Recovery Plan (SPSS 2007) is, itself, BAS? If so, what is the basis for that proposition?

12. Page 8. Why does the discussion regarding Westcott and Garrison Bays and alleged impacts of logging, agriculture and "residential development" omit any discussion or citation of the Eelgrass Stressor Response Project, whose findings "strongly suggest that PAR [photosynthetically active radiation or sunlight] is not an important controlling factor on Z. marina [eelgrass] abundance in the Westcott Bay area. This conclusion is supported by the stark differences in Z. marina abundance and survival – Z. marina is abundant at the mouth of the bay and severely restricted at Bell Point, two sites with indistinguishable average levels of PAR"? [Underwater Light Availability in Westcott Bay, p. 2, April 2009, PSAMP – Puget Sound Assessment and Monitoring Program, Washington State Department of Natural Resources].

PAR is just one of the potential effects associated with logging, agriculture and residential development. Water quality (e.g., nutrient and toxics loading), physical disturbance, and fine sediment deposition have all been demonstrated in the scientific literature to impair eelgrass growth and increase mortality. These effects could all result (directly or indirectly) from logging, agriculture and residential development. In fact, the results of the shoreline characterization work currently underway indicate that the Roche Harbor Management Area is by far one of the most developed management areas in the County with regards to certain types of shoreline modification and development.

13. Page 9. What is the authority for the proposition, at page 9, that "Doe Creek is currently experiencing significant erosion and downcutting, which likely contributes to adverse downstream sedimentation"?

14. Page 9. What is the authority for the assertion that "high fecal coliform, nutrients, suspended solids, temperature, and low dissolved oxygen levels," are commonly associated with "development activities," as opposed to agriculture?

15. Page 9. Is it asserted that Barsh *et al.* (2009), cited at page 9, represents BAS? If so, in what ways does it satisfy the standards in WAC 365-195-905? Who is R. Barsh, what are his qualifications to make the determination cited, and where is his CV available for review by the public?

16. Page 9. If, as the Draft Synthesis states, some shellfish species "prefer sediment mixed with gravel and cobble; and populations are sometimes enhanced by increased amounts of these sediments to otherwise muddy or sandy beaches," how does "development such as bulkhead construction, vegetation removal, or other activities that alter sediment composition . . . adversely affect a variety of shellfish species"?
In cases where development (such as bulkhead construction or the removal of riparian vegetation) alter erosion rates and sediment transport, these activities can increase the amount of fines and make the substrate less suitable for shellfish that rely on gravelly substrates.

17. Page 10. The Draft Synthesis states:

> "*O+verharvest is thought to be a significant problem for this species (NMFS 2007, West 1997), and populations along the west coast of the United States and Canada have experienced dramatic declines in the last few decades (NMFS 2007, PSRF 2010). **An ongoing threat is that current population levels are likely too low to support effective reproduction** (Dethier 2006, NMFS 2007). The decline in population is attributed to several factors including overharvest (historical overharvest and ongoing illegal, unreported harvest), predation from sea otters, and disease. **These factors have contributed to densities that are too sparse to support sustainable, viable reproduction** (NMFS 2007).
> Based on these findings, isn't habitat protection unlikely to have any effect on the survival of the species? Why is the contrary conclusion stated in the Draft Synthesis?
> **The protection of habitat is important even in this circumstance. The decrease in population levels does not mean that the species is no longer present and should no longer be protected. Efforts to protect habitat lend opportunity for the species to rebound in the future if environmental or harvest conditions change.**

18. Page 10. Why is the reference "(Rodgers-Bennett 2007)" at page 10 not included in the Literature Cited section of the chapter? Please identify that reference so that the public will have an opportunity to identify and review it.
Reference unintentionally omitted. To be added:

Rogers-Bennett, L. 2007. Is climate change contributing to range reductions and localized extinctions in northern (*Haliotis Kamtschatkana*) and flat (*Haliotis Walallensis*) abalones? Bull. Mar. Sci., 81(2): 283–296, 2007

19. Page 10. Why does the Draft Synthesis, at page 10, refer to "reciprocating benefits" between kelp and abalone, but fail to identify any benefit provided by abalone to kelp?

20. Page 11. The Draft Synthesis at page 11 reports that: "In general the Puget Sound sea urchin population is considered stable, although population declines in specific geographic areas have prompted harvest restrictions or closures for stock conservation (PSAT 2007)." Are any of the threatened areas within SJC? If not, is there any scientific evidence that the sea urchin population in San Juan County is at risk?

21. Page 12. At page 12, the Draft Synthesis states that "development activities that result in direct disturbance or impaired water quality related to increased pollutants are likely factors in low population success." What specific "development activities"? What is the authority for the authority for this proposition?

22. Page 12. What is the basis for the apparent conclusion that these effects are caused by "development activities," as opposed to agriculture?

23. Page 12. How does the cited source (Bernatis 2007) attempt to quantify the likelihood and impact of the "threat" as a function of various levels and intensity of development?

24. Page 13. The Draft Synthesis states:

> Due to the dependence of juvenile crab on this habitat for refuge from predators, eelgrass habitat (and the conservation of eelgrass) is important for crab survival in San Juan County. **Development related impacts and the subsequent loss of intertidal habitat, or alteration of habitat (**such as removal of suitable breeding substrate, or reduced water quality) are direct and indirect limiting factors for Dungeness crab populations (Fisher and Velasquez 2008).
> (Emphasis added.) Why is (Fisher and Velasquez 2008) not included in the Literature Cited Section of the chapter? Please identify that reference so that the public will have an opportunity to identify and review it.
> **Reference was included in original draft.**

25. Page 13. The Draft Synthesis indicates that "to the extent that development impacts extend to deeper waters where Pandalid shrimp inhabit the subtidal zone," threats are likely to be similar to those discussed for crab. Do development impacts in San Juan County "extend to deeper waters" or not? What evidence satisfying the requirements of WAC 365-195-905 establishes that proposition?

26. Page 14. At page 14, the Draft Synthesis concludes that: "In San Juan County it [geoduck] is likely precluded from most intertidal areas due to unsuitable habitat conditions." Please explain why protection of geoduck habitat is then still proposed for San Juan County?

27. Page 15. At page 15, the Draft Synthesis states:

> Development activities that result in impacts to water quality, direct disturbance of substrate, or indirect alteration of substrate conditions, are potential threats to oysters and clams. Barsh et al. (2010) attributed local water quality degradation to low summer instream flows, use of the riparian corridor for cattle pasture, pesticide use, and untreated runoff from roads, and found that water quality related to local development may be contributing to pesticide contamination of bivalves in Fishing Bay (Barsh 2009).
> Is it asserted that Barsh *et. al* 2010 and Barsh 2009 represent BAS? If so, how do they satisfy the requirements of WAC 365-195-905? Who is R. Barsh and what are his professional qualifications to make the determination cited? Where is his CV available for review by the public?

28. Page 17. At page 17, after reporting a variety of speculations (*i.e.*, ". . . may reduce . . . could result . . . could also be reduced . . .) with respect to threats to kelp, the Draft Synthesis concludes: "Of these potential threats, the impacts associated with water quality are primarily related to land development practices, and potentially occur because of increased pollutants or sediment delivery." Why it is not more likely that these threats are related to agricultural activities than residential development?

29. Page 19. At page 19, regarding eelgrass, the Draft Synthesis states the eelgrass bed areas vary only slightly from year to year "in the absence of impacts from human activities that may contribute to reduced distribution and density." What supports this conclusion, given that the Draft Synthesis reports a widespread, steady decline that it attributes to human activities? Where are the stable populations?

30. Page 19. The Draft Synthesis concedes that there is "no conclusive evidence substantiating the exact cause of declining eelgrass abundance in San Juan County" and acknowledges that the frequent assumption that bulkheads are detrimental to eelgrass is undermined by the findings of Finlayson (2006). Why doesn't the Draft Synthesis address the findings of the Eelgrass Stressor-Response Project, which has concluded that eelgrass failures are not the result of reduced available sunlight but may be due to stressors and processes "triggered by climate change, as well as climatic events such as the 18.6 year tidal epoch in the Northeast Pacific, El Niño Southern Oscillation (ENSO) and the Pacific Decadal Oscillation (PDO)"? **Eelgrass Stressor Response Report 2007-2008*, p. 3, February 2010, PSAMP - Puget Sound Assessment and Monitoring Program, Washington State Department of Natural Resources].
Herrera response?

31. Page 19. Is the slime mold *Labyrinthula* being investigated as a possible cause of the loss of eelgrass in Westcott and Garrison Bays?
It is not known if further investigations are being conducted or planned for the future.

32. Page 20. At page 20, the Draft Synthesis discusses the identification of "potential . . . use of nearshore marine habitats by forage fish" and "potential forage fish spawning beaches." What is the relevance of "potential" habitat for purposes of the protection required by the GMA?

33. Page 20. If an area is not being used by a species, how does it meet the definition of a fish and wildlife habitat conservation area under WAC 365-190-030(4)(b)(6)(a) (*i.e.*, "areas that serve a critical role in sustaining needed habitats and species for the functional integrity of the ecosystem, and which, if altered, may reduce the likelihood that the species will persist over the long term") ?

34. Page 20. How does a species have "primary association" with an area it does not use? WAC 365-190-130(2)(a).

35. Page 20. How can an area be considered a "spawning area" if it is not actually used for spawning? WAC 365-190-130(2)(d).

36. Page 20. The Draft Synthesis states:

> Friends of the San Juans (2004a) provides considerable information on the specific locations (including maps) of surf smelt (Hypomesus pretiosus) and Pacific sand lance (Ammodytes hexapterus), as well as information on current development related conditions that likely impair habitat quality.
> Is it the assertion of the authors that statements or reports by the Friends of the San Juans represent BAS? If so, on what basis?

37. Page 20. Does the statement highlighted in the prior question reflect the opinion of the Friends of the San Juans, or the evaluation of the authors of the Draft Synthesis?

38. Page 21. Why is the reference "(Stick and Lindquist 2009)" at page 21 not included in the Literature Cited section of the chapter? Please identify that reference so that the public will have an opportunity to identify and review it.

39. Page 21. Is there any authority independent of the authors for the proposition at page 21 pf the Draft Synthesis that: "The locations and seasons of herring spawning in Puget Sound are relatively well known. However, new spawning sites in the Puget Sound region are still being discovered (EnviroVision et al. 2007)"?

40. Pages 21 and 22. The Draft Synthesis cites "(Barsh and Wyllie-Echeverria 2006; Wyllie-Echeverria and Barsh 2007)." Is it asserted that these two reports represent BAS? If so, please identify the authors and their professional qualifications to make the determination cited? How do these satisfy the requirements of WAC 365-195-905?

41. Page 22. The Draft Synthesis asserts that "Development that results in the loss of suitable spawning habitat, for example from bulkhead construction (described in Section 3.3.1), and increased exposure to pollutants . . . are also potential threats. Recent declines in another Puget Sound location (Cherry Point), and **lacking definitive explanation for the decline,** have led to heightened concern about the fate of this species (PSP 2010)." Section 3.3.1, to which this quotation cross-refers, acknowledges significant data gaps and admits that "specific localized effects of bulkheads have not been thoroughly identified in San Juan County." Draft Synthesis at page 60. Has bulkhead construction been proven to be the cause of any actual habitat loss in San Juan County?

42. Page 23. Is there any authority independent of the authors for the proposition that "forage fish are vulnerable to the impacts of shoreline development, including threats from bulkheads and shoreline hardening, over-water structures, pollution runoff, and removal of shoreline aquatic vegetation (Herrera 2007a)?

43. Page 23. Is there any authority independent of the authors for the proposition that "forage fish are vulnerable Please explain how "[e]xisting roads . . . along the backshore . . . on potential spawning beaches also likely impact the ability of these areas to function for spawning."

44. Page 23. Is there any authority independent of the authors for the proposition that "forage fish are vulnerable The Draft Synthesis suggests that the construction of bulkheads damages "marine riparian forest along the backshore of beaches." Draft Synthesis at 23, 59. Why wouldn't properly constructed bulkheads actually protect such vegetation?

45. Page 26. The Draft Synthesis acknowledges that all federally-designated Steller sea lion critical habitat lies outside Washington State. Moreover, the NMFS has recently announced the receipt of "substantial scientific or commercial information" indicating support for the granting of recent petitions by the State of Washington and others to delist the Steller sea lion. 75 FR 77602 (Dec. 11, 2010). In light of these facts, what is the basis for suggesting that San Juan County CAO should address the Steller sea lion?

46. Pages 32-33. Is there any evidence that, but for overfishing and other threats outside the control of San Juan County (*e.g.*, hatchery practices, PCBs, competition from other species, genetic changes), there would be any reduction in rockfish abundance in San Juan County?

47. Page 34. The Draft Synthesis states that: "San Juan County likely provides ideal conditions for the formation of drift mats including high aquatic vegetation productivity, storm exposure, and invertebrate communities that dislodge kelp and other macrophytes by grazing." What does this mean? How does it support the stated conclusion that "Therefore, San Juan County shorelines may be at a higher risk for impacts to rockfish related to shoreline development and habitat disturbance than other areas of Puget Sound"?
Floating mats of dislodged aquatic vegetation provides habitat for juvenile rockfish. Many areas in the San Juan County aquatic environment are (1) high in productivity of kelp and seagrasses, (2) exposed to storms, and (3) grazed by invertebrates that dislodge the vegetation. This combination provides excellent habitat for juvenile rockfish. Potential impacts to this habitat would therefore have a higher than average impact to the species than other areas of Puget Sound.

48. Page 34. With respect to Table 1, has a risk assessment quantified likelihood and impact of these proposed stressors?

49. Page 34. For purposes of Table 1 and the Chapter overall, how are "riparian buffer functions" defined?

50. Page 36. The Draft Synthesis states, with respect to boccacio, that: "Because this species is so slow-growing, late to mature, and long-lived, recovery from the above threats will take many years, potentially even after the threats are no longer affecting the species (NMFS 2010e)." Does this indicate that there is a risk of overcorrection if successful protection of habitat is evaluated based on species population or sightings?

51. Page 39. Why is the reference "(Barsh and Murphy 2007)" at page 39 not included in the Literature Cited section of the chapter? Please identify that reference so that the public will have an opportunity to identify and review it.
Reference added to recent draft

Barsh, R. and M. Murphy. 2007. Origins of Juvenile Chinook in San Juan County, Washington. Final Report to the San Juan County Marine Resources Committee. KWIAHT, PO Box 415, Lopez, WA 98261.

52. Page 40. The Draft Synthesis acknowledges that "[t]ypically cited nearshore habitat requirements of juvenile salmonids" do not consistently occur in San Juan County, but appears to suggest that it is sufficient that "San Juan

County likely includes areas representing each of the listed habitat requirements above based on a general review of available data." What is the scientific basis and authority for this proposition?

53. Page 42. The Draft Synthesis states:

> [H]uman activities including increasing residential development, vegetation removal, agricultural practices, and shoreline development have likely contributed to altered water quality . . . , influenced habitat forming processes such as erosion and shore drift . . . , and subsequently impaired habitat conditions over time.
> Is there any evidence isolating the actual impacts of these discrete human activities?

54. Page 42. Is there any evidence that these human activities have actually had the specified adverse effects on our local environment?

55. Page 42. The Draft Synthesis discusses the Puget Sound Salmon Recovery Plan, Shared Strategy for Puget Sound, Shared Strategy Development Committee Plan. Is it asserted that the Salmon Recovery Plan itself represents BAS? If so, in what respects does the Plan satisfy the requirements of WAC 365-195-905?

56. Page 42. The Draft Synthesis suggests that protection of nearshore salmon habitats should be a priority in San Juan County because of the relative abundance of those habitats. Why doesn't that abundance actually suggest that heightened protections are not necessary here?

57. Page 43. Rather than identifying the birds that are actually known to use San Juan County, the Draft Synthesis instead refers to "likely" species. Is it asserted that San Juan County is required to protect habitat for species that have not been proven to be present in the County? If so, why, and on what authority?

58. Page 43. The Draft Synthesis states that "A number of species have been documented to congregate in response to forage fish concentrations. Protection of forage fish areas will in turn provide added protection for the bird species that prey upon them." Which species, and what is the authority for these propositions?

59. Page 43. The Draft Synthesis cites the Audubon Society for the proposition that the marbled murrelet "winters in the San Juan marine waters." Is there any evidence that the species is present in San Juan County? If so, why is none cited?

60. Page 43. The Draft Synthesis devotes more than three pages to discussing the brown pelican even though it reports that: "Use of marine waters off San Juan County by the species excludes breeding and rearing, and non-breeding habitat use in the County has not been recorded in the literature."

61. Page 43. Please explain how "the protection of forage fish populations in San Juan County may enhance foraging success of pelicans in winter" when the evidence cited by the Draft Synthesis indicates that the species is not present in the County.

62. Page 43. What evidence cognizable under state law supports the proposition that the brown pelican is actually present in San Juan County?

63. Page 47. Please explain how "[e]nhancement of wetlands adjacent to potential oil contamination sources would also act to protect marine waters from water quality issues related to oil." What is the basis for the apparent proposition that San Juan County has an obligation to protect against the impact of land use outside the County (*e.g.*, operating an oil refinery)?

64. Page 47. The Draft Synthesis devotes over three pages to the common loon even though it acknowledges that: "Nesting bird protections are not necessary in San Juan County," and that [p]redominant threats to loons in marine waters include boat disturbance, fishing line entanglement, and fishing lure and line ingestion . . . . Other factors potentially impacting the birds in the marine environment are oil spills, toxins, disease, predation, and hunting or

other persecution . . . .” What evidence exists demonstrating that land uses in San Juan County actually cause any of these potential impacts to loons?

65. Page 47. How much prey constitutes “abundant” prey?

66. Page 54. The Draft Synthesis refers to development activities at a regional or cumulative scale. Is it asserted that San Juan County is required to address activities that occur outside the County? If so, why, and what is the basis for that proposition?

67. Page 54. The Draft Synthesis discusses certain “findings” reflected in the San Juan County Marine Stewardship Area Plan. Is it asserted that the San Juan County Marine Stewardship Area Plan represents BAS? If so, how do they satisfy the requirements of WAC 365-195-905?

68. Page 55. The Draft Synthesis discusses the concept of “feeder bluffs.” Is there any authority for this concept other than (MacLennan et al., 2010) and (Johannessen and MacLennan 2007)?

69. Page 55. Has the theory of “feeder bluffs” put forth in the two cited sources ever been tested under laboratory or field conditions?

70. Page 55. The Draft Synthesis states:

> Riprap, retaining walls (such as bulkheads), groins, and other forms of shoreline armoring can have a number of adverse impacts on the marine shoreline environment (Herrera 2007a,b,c). The construction of these types of structures in most cases results in loss of terrestrial, shallow-water, and benthic habitat.
> Is there any authority independent of the authors for the proposition?

71. Page 55. Isn’t true that, in some cases, beach formation has occurred seaward of bulkheads? Why isn’t this phenomenon discussed in the Draft Synthesis? *See, e.g.*, Draft Synthesis at 58 (“new sediment deposits in the vicinity of the structure”).

72. Page 55. How many hard shoreline protections structures have been permitted in San Juan County, and over what timeline?

73. Page 56. The Draft Synthesis states: “Many of these impacts can be minimized through proper design, but rarely avoided entirely. In addition, the cumulative impacts from multiple shoreline armoring projects are potentially significant.”

This statement indicates that it is possible to avoid adverse impacts from bulkhead construction if done properly. In what ways can this be accomplished?

74. Page 56. Have there been any scientific studies regarding the alleged “cumulative impacts” of multiple projects?

75. Page 56. Where in San Juan County have multiple projects resulted in material “cumulative impacts”? Identification of such would help the public understand the issues and enable qualified personnel to evaluate the risks.

76. Page 57. The Draft Synthesis asserts, without citing any specific examples, that “there are many instances when . . . impacts have already caused modifications to the overall landscape that have compromised the habitat functions of a particular site.” Please identify the locations where this is found to have occurred in San Juan County so that they can be reviewed and evaluated by qualified engineers.

77. Page 57. Is the assertion that San Juan County is required to restore the landscape to some prior state, as opposed to protecting against net losses going forward? If so, what is the basis for that proposition?

78. Page 57. The Draft Synthesis asserts, without citation to any authority, that: "a considerable portion of the coast is also unconsolidated sediment. These areas function as feeder bluffs supplying sediment to beaches. Due to the lack of rivers in San Juan County, most beaches depend solely on bluff erosion for sediment." What is the authority for these propositions? Why isn't it cited in the Draft Synthesis for public review and scrutiny?

79. Page 57. Isn't true that the "feeder bluff" theory is not universally accepted? Why hasn't the contrary view been discussed in the Draft Synthesis?

80. Page 57. Has the role of Frasier River sedimentation upon San Juan County been considered and studied? If not, why not, given the huge volume of sediment it produces?

81. Page 57. Has the role of Skagit River sedimentation upon San Juan County been considered and studied? If not, why not, given the huge volume of sediment it produces?

82. Page 57. The Draft Synthesis states: "When a drift cell carrying sediment encounters a bedrock formation or a particularly steeply sloping area along the shoreline, the sediment carried by the drift cell is transported offshore and is permanently "lost" to the nearshore environment." Please explain the "drift cell" concept and the mechanisms underlying this assertion. If County land use policy is to be based on these theories, it is essential for the concepts to be fully explained so that they can be understood by the public and reviewed by qualified engineers.
Johannessen and MacLennan (2007) is an excellent reference to understanding the drift cell processes. A drift cell is comprised of three basic components: (1) a sediment source (usually an eroding bluff); (2) a transport zone where sediments are moved along the shoreline over time; and (3) a depositional area. For the situation described above where bedrock formations block most of the nearshore deposition, the depositional area would be offshore.

83. Page 57. The Draft Synthesis states that bulkheads "can alter wave energy." The use of "can" suggests that this does not necessarily occur. Are there any locations in San Juan County where this is happening? Please identify these locations so that they can be reviewed and better understood.

84. Page 57. The Draft Synthesis further states: "Regardless of the specific type of structure (or nature of shoreline hardening) the altered relationship between topography and wave energy results in a shoreline that is out of equilibrium with natural shoreline processes." Please explain what this means—what is "equilibrium with natural shoreline processes"?
Transformation of a shoreline from its natural state by installing some form of shoreline hardening would change the way waves interact with the shoreline and thus alter the natural equilibrium. For example, this may change the way substrates move along the shoreline or it may change the rate of erosion processes on or adjacent to the altered site.

85. Page 57. The Draft Synthesis further states that alterations due to redistributed wave energy "can affect the movement of spawn and larvae, increase shear stress and burial, alter water column stratification, and alter the distribution of aquatic vegetation (Herrera 2007)." Please explain what is meant by "alter water column stratification"?
Water column stratification refers to the natural temperature and salinity gradients which form in the water column.

Is there any authority independent of the authors of the Draft Synthesis for this proposition?
Another source cited in the Herrera (2007) White Paper referenced in the CAO BAS is Qiao (2006).
Qiao, F.L., J. Ma, C.S. Xia, Y.Z. Yang, and Y.L. Yuan. 2006. Influences of the surface wave-induced mixing and tidal mixing on the vertical temperature structure of the Yellow and East China Seas in summer. Progress in Natural Science 16(7): 739-746.

86. Page 57. What is the basis and authority for the suggestion that additional structures necessarily increase the amount of disturbance? Isn't it just as likely that once the "natural" flows have been disrupted, additional impediments would not have further impact? Please explain the theory and authority for these conclusions.
This is the notion of cumulative impacts. Even small incremental impacts can have compounding affects when assessed together.

87. Page 58. The Draft Synthesis cites studies in the San Juan Islands finding a relationship between tidal currents and predation on forage fish, but does not cite any authority for the proposition that "some shoreline structures can alter tidal current flow patterns." Please explain the basis for this speculation. Has this theory been studied?

88. Page 58. Has a material effect on tidal currents as a result of common shoreline structures been demonstrated in San Juan County? If so, has that effect been shown to affect forage fish in San Juan County?

89. Page 58. The Draft Synthesis discusses possibilities in connection with erosion and beach conditions, without citing any authority, stating: "can cause . . . can isolate . . . can reflect . . . can lead to . . . may eventually . . . can also . . . can lead to."

90. Page 58. Why isn't any authority cited for these propositions that form the basis for so many of the conclusions and recommendations in the Draft Synthesis?

91. Page 58. Is there evidence demonstrating that these possibilities are actually occurring in San Juan County?

92. Page 59. The Draft Synthesis discusses potential for effective beach renourishmant to address anticipated effects of bulkhead placement at "feeder bluffs," but concludes: "However, the placement of a bulkhead may require continual and frequent nourishment, which may exceed the frequency of natural disturbance effects; thus adversely affecting benthic communities over time. This is particularly the case if the nourishment events have the potential to interfere with annual recruitment cycle of benthic species." Have any studies been conducted regarding the frequency of beach renourishment that would be required in San Juan County circumstances? If not, what is the basis for the stated conclusion?

93. Page 59. What is the frequency of "natural disturbance events" and is it constant?

94. Page 59. Please explain what is meant by the "annual recruitment cycle of benthic species"?
This refers to the ability of benthic species to move in ("recruit") to shoreline areas.

95. Page 60. The Draft Synthesis states: "This is particularly true given the predominance of shoreline modifications along not just feeder bluffs but also along transport zones, accretion shoreforms, and pocket beaches, all of which provide habitat for important marine species . . . ."

96. Page 60. What is meant by "predominance of shoreline modifications"? Predominant compared to what?

97. Page 60. Please explain what is meant by "transport zones" and how they relate to the discussion in the Draft Synthesis.
Transport zones are part of a drift cell. They are shoreline areas in which sediments are predominantly moving along the shoreline. However, at the same time, these transport zones also provide some sediment supply from shoreline erosion processes, and may include temporary depositional areas. As such, transport zones are important for habitat development and geormorphic processes.

98. Page 60. The Draft Synthesis concludes "Based on current available science, alternative soft shoreline protection and stabilization methods can be considered reasonable alternatives to bulkhead construction as long as it can be shown that the location, design, materials and construction methods would not significantly impact coastal processes, functions, and intertidal conditions." Since the synthesis was supposed to reflect Best Available Science,

is “current available science” as used in the Draft Synthesis synonymous with BAS, or something else? If it something else, what is it and why is it being discussed in the Draft Synthesis?

99. Page 60. Are soft protection alternatives as effective at protecting property as properly constructed bulkheads? **This certainly depends upon site conditions and the type of design. However, soft shoreline armoring does tend to dissipate wave energy more than traditional bulkheads (traditional bulkhead tend to reflect wave energy), thereby decreasing the nearshore erosion forces.**

100. Page 60. What would be required in a particular case to show “that the location, design, materials and construction methods would not significantly impact coastal processes, functions, and intertidal conditions”?

101. Page 61. Please explain the conclusion at page 61 of the Draft Synthesis that “bulkheads are most likely to become a preferred alternative where narrow setbacks and high shoreline erosion rates occur.”

102. Page 61. The Draft Synthesis states: “Siting a structure away from the hazard area would likely be less impacting [sic] on species, habitat and sediment transport, and potentially be more cost-effective, particularly given the range of potential impacts including affects [sic] on neighboring properties.” What is meant by “the hazard area”? Is it assumed that the desire to protect shoreline property is limited to situations involving a hazard?

103. Page 61. More cost effective for whom? What are the assumptions underlying this statement?

104. Page 61. What does a potential “affect [sic] on neighboring properties” have to do with protection of critical areas under the CAO.

105. Page 61. What is the basis for the assertion that “[d]ocks and piers typically result in similar impacts as marinas”? Has this been studied in the San Juan County?

106. Page 61. What is the basis for the conclusion that “[o]ther inwater structures which are not specifically addressed in this summary, but are noted as having similar impacts on marine HCAs, include jetties and breakwaters.”

107. Page 61. Have these structures been studied independently? What sources address those studies and applicable conclusions?

108. Page 61. Are there any differences in the effects of these types of structures that might influence planning for purposes of the CAO?

109. Pages 61-62. What is the basis for the characterization at pages 61-62 of the Draft Synthesis of a marina as simply “a collection of individual piers”? Why doesn’t the Draft Synthesis discuss potentially significant differences (*e.g.*, traffic volume, size of vessels, fueling and maintenance services, etc.) between the operation of a marina and a dock associated with a residence?

110. Page 61. The Draft Synthesis indicates that there is a considerable body of literature regarding shading from shoreline structures, but cites only “(Herrera 2007b)” and does not discuss how the purported effects can be reduced or otherwise addressed. Are there steps that can be taken (*i.e.*, building materials and methods, orientation, etc.) to address the identified effects of shading short of refusing to allow a structure to be built? Why aren’t these approaches discussed in the Draft Synthesis?

111. Pages 62-63. What is the basis for the summary conclusion that boat launches have the same effect as bulkheads on the environment?

112. Page 64. The Draft Synthesis indicates that more information is needed regarding “cumulative and synergistic effects of multiple docks and other overwater structures.” Is there any authority for the proposition the multiple

docks produce synergistic effects? If so, please identify it so that it can be reviewed by the public and qualified engineers.

113. Page 64. Isn't it also possible that multiple docks might cancel or balance each other's effects?

114. Page 64. Does the citation to the US Army Corps of Engineers design criteria for residential docks (USACE 2005) indicate that satisfying these standards would be consistent with BAS for allowing these structures?

115. Page 65. Why is the reference "(Seattle 2005)" at page 65 not included in the Literature Cited section of the chapter? Please identify that reference so that the public will have an opportunity to identify and review it.
Reference unintentionally omitted:

Seattle, City of. 2005. Environmentally Critical Areas Best Available Science Review.. City of Seattle, Department of Planning and Development. August, 2005.

116. Pages 65-66. The Draft Synthesis identifies eight areas in the County purportedly found to have "obviously impaired water quality." With one possible exception (Site 11, Orcas Eastsound), these areas appear to be primarily affected by agricultural activities rather than residential development. How does the BAS address specifically the effects of agriculture, and why does the Draft Synthesis not discuss them?

117. Pages 66-67. The Draft Synthesis relies heavily on four papers purporting to describe local conditions, (Barsh 2009) and (Barsh et al. 2008, 2009, 2010). These do not appear to be scientific papers or to have been peer-reviewed or published. Nor do they identify the professional qualifications of the authors. What is the basis under WAC 365-195-905 for consideration of these materials in the BAS review? Please provide a complete CV for all cited authors so that their qualifications can be reviewed by the public.

118. Page 66-67. The only citation for the "study of water quality in San Juan County" reportedly completed by Huxley College is a County unpublished report listing references. This clearly fails to qualify as BAS. That County list, in turn, includes two references to Huxley College—one is a 1996 senior student thesis, and the other is a 1973 study on soils. Neither appears to constitute a study of water quality "by Huxley College," much less BAS. Why is such an important element of the Draft Synthesis unsupported by creditable references?
There are results from two technical studies cited in the BAS report for studies of water quality in the San Juans. These are:

Wiseman, C., R. Matthews and J. Vandersypen. 2000. San Juan County Monitoring Project Final Report. Institute for Watershed Studies, Huxley College of Environmental Studies, Western Washington University, October 2, 2000.

and

SJCWMC 2000. San Juan County Watershed Management Committee. San Juan County Watershed Management Action Plan and Characterization Report. August 24, 2000. http://www.co.san-juan.wa.us/health/wtrshdpln/part2toc.html

More recently, the San Juan County Conservation District with a grant from Ecology conducted a volunteer-based monitoring program from March 2002 to December 2005 (SJCD 2005). The study consisted of data collection on an approximate 4 to 6 week interval from 24 sampling locations (marine and freshwater). Samples were analyzed for temperature, pH, dissolved oxygen, turbidity, and fecal coliform. A summary of the data results by site is provided below:

San Juan Island

- **Site BV-1, Halverson Rd near Roche Harbor Rd – low DO**
- **Site BV-2, Barn Swallow Way near Beaverton Valley Rd. – low DO**
- **Site BV-3, University Rd. near Tucker Rd. – no issues**
- **Site FB-1, Julie Rd. near Kiehl Rd. – slightly low DO**
- **Site FB-2, Club Mud Rd. near Wold Rd. – high fecal coliform**
- **Site FB-3, Valley Farm Rd. near San Juan Valley Rd. – high fecal coliform**
- **Site FB-4, Bailer Hill Rd at False Bay Drive – high turbidity and fecal coliform**
- **Site FB-6, Bailer Hill Rd. 0.7 miles from False Bay Drive – high turbidity and fecal coliform**

Lopez Island

- **Site SB-1, Cross Rd. near Port Stanley Rd. – high turbidity and fecal coliform**
- **Site FM-2, Outfall north of Lopez and Weeks Rd – elevated turbidity, low DO**
- **Site FM-3, Outfall in Fisherman's Bay 100 ft south of Erisman Dr. – elevated turbidity**
- **Site DB-4, Davis Bay Rd. near Burt Rd. – no issues**
- **Site DB-5, Richardson Rd. near Davis Bay Rd. – no issues**
- **Site LS-6, Lopez Sound Rd near School Rd. – no issues**

Orcas Island

- **Site O1, Willow Creek Ln and Killebrew Lake Rd. – low DO**
- **Site O2, Deer Harbor Rd. – high temperatures**
- **Site O3, Deer Harbor Rd near Crow Valley Rd. – low DO**
- **Site O4a, near Nordstrom Ln. and Crow Valley Rd. – high fecal coliform**
- **Site O5, Main St. near Orcas Rd. – low DO**
- **Site O6, Rosario Rd. near Orcas Rd. – no issues**
- **Site O7, Pt. Lawrence Rd. at head of Buck Bay – no issues**
- **Site O8, Doe Bay Resort parking lot – low DO and very high fecal coliform**
- **Site O9, Forest Lane near Eagle Lake Community – low DO**

It should be noted that none of these sampling programs included targeted storm sampling. Due to the fact that the majority of surface water pollutants are elevated in storm flow relative to base flow, it is likely that the monitoring that has been conducted in San Juan County to date has underestimated average annual pollutant concentrations.

119. Pages 67-69. The Draft Synthesis notes several effects upon marine habitat areas that it characterizes as "likely" or "actually likely" as a result of removal or alteration of marine riparian vegetation. Are there any documented cases in which these effects have in fact occurred within San Juan County?

120. Pages 67-69. Even the reporting regarding the extent to which marine riparian vegetation has been removed is unclear in the Draft Synthesis. For example, the Draft Synthesis states at page 70: "Approximately 1,000 survey sites in San Juan County, including potential forage fish spawning areas, were documented with shading of less than 50 percent (Friends of the San Juans 2004a)." Less than 50% of what?

121. Pages 67-69. Is there any scientifically significance to a 50% value in relation to protection of the functions and values of the ecosystem?

122. Page 70. The Draft Synthesis concludes, without citation of any authority, that:

> "It is also likely that juvenile salmon and other species sensitive to temperature (for example, some shellfish species discussed in this document) are adversely affected by reduced shade to the extent that it impacts water temperature in the nearshore zone. This would particularly be the case in areas with limited water circulation, mixing, or exchange." Is there any reliable data from San Juan County supporting the asserted likelihood?

123. Page 70. Doesn't this suggest that greater vegetation removal could reasonably be allow in areas with good circulation, mixing, or exchange? Why isn't this suggested in the Draft Synthesis?

124. Pages 72-77. The Draft Synthesis discusses theories and hypotheses regarding marine riparian buffers. One of the concepts it discusses, but does not explain, is the SPTH Method or FEMAT curve method. Please explain what these methods are and how they would be applied in San Juan County.
Further clarity added to revised draft

125. Pages 72-77. The Draft Synthesis suggests that the County "could use the available scientific guidance to develop variable buffers for each type of marine HCA and site conditions." To what types of Marine HCA does the Draft Synthesis refer? Why doesn't the Draft Synthesis provide any additional information about how the County might go about this?

126. Pages 72-77. The Draft Synthesis appears to confuse the concept of buffers and setbacks stating: "Activities that pose a higher risk of adverse effects on marine HCAs may require additional 'setbacks' with limitations on uses." How is a "setback with limitations on uses" different from a "buffer"? To what activities does this sentence refer?

127. Pages 77-86. How are "personal communications" or "unpublished observations" part of BAS?

128. Appendix A. The explanation in Appendix A appears truncated. It states "Distribution maps in the PHS List were developed using the best information available. As new information becomes available, know." What is the rest of this sentence intended to say?
This "Important Note" was unintentionally cut short. This sentence should read:

> **"As new information becomes available, known distribution for some species may expand or contract. WDFW will periodically review and update the distribution maps in the PHS list."**

129. Appendix A. Why was the list prepared using "the best information available," instead of BAS?

130. Appendix A. How does BAS support the inclusion of any species that has not actually been documented to exist within the County? How is that not simply speculation?

131. Appendix A. The explanation regarding the List states: "Over time, species can naturally change their distribution and move to new counties where usable habitat exists." Is it the assertion of the authors that San Juan County must protect habitat for species that are not shown to exist in or to regularly visit the County?

132. Appendix A. Why does the List of Priority Habitats and Species included in Chapter 3 include species and habitats that are entirely terrestrial?