The Effect of Seas Branch Pond

on

Seas Branch

Vernon County
Wisconsin

December 16, 2004
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Wisconsin Department of Natural Resources

Seas Branch is a 4.5 mile long tributary to the West Fork of the Kickapoo River in central Vernon County. The stream flows in an easterly direction with a gradient of 50 feet/mile before reaching the West Fork of the Kickapoo River near Avalanche. Approximately 2.6 miles upstream from the mouth, a Public Law 566 water control structure, built in 1966, transects the stream to create the 11 acre Seas Branch Pond. Complaints of water clarity problems in Seas Branch downstream of the pond prompted the Wisconsin DNR to investigate the source of the problem and potential solutions. Ideally, chemical, physical and biological data should have been collected more frequently over a longer period of time. However, due to budget and time constraints, different types of data were collected over a period of many years (1997 to 2004).

Generally, large, shallow, eutrophic lakes and impoundments are found in southwest Wisconsin. Natural lakes are rare due to the severe topographic relief of the region. Southwestern Wisconsin lakes tend to have high phosphorus, high chlorophyll and low water clarity. Seas Branch Pond is no exception.

Figure 1. Seas Branch Pond from dam embankment looking upstream with outlet in foreground. (Vernon County Land & Water Conservation Department)

Figure 2. Seas Branch Pond at inlet looking toward dam embankment. (Vernon County Land & Water Conservation Department)

The Seas Branch watershed (including the pond) is 14 square miles and consists of approximately 75% agriculture and 25% forested land. The steep slopes are largely covered by deciduous trees. Conversely, the flatter valleys and ridge tops contain agriculture consisting mainly of corn, soybean, and hay. Nearly all of the agricultural fields contain contour strips in order to reduce soil erosion.

The amount of land draining to Seas Branch Pond is only 5 square miles. However, the land cover breakdown is the same at 75% agriculture and 25% forest. See figures 3 and 4 for maps of the watershed and land cover. A gravel pit exists upstream of Seas Branch Pond. Past management of this pit resulted in pulses of fine sediment entering Seas Branch above the pond. Stormwater management of the gravel pit has improved over time keeping fine sediment on site. The ratio of lake size to watershed size is 1:285 for Seas Branch Pond, which is below average for impoundments in the state (Lillie and Mason, 1983). This ratio influences the residence time of water in the pond and was used to estimate the residence time of water in the Seas Branch Pond to be from 15 to 60 days. Other influences of residence time is lake depth, stream inflow and lake outflow. Seas Branch Pond has an average depth of 6 feet. The lake bed is nearly level, with no deep holes and no discernable channel through the pond.

Seas Branch Water Chemistry

On August 13, 2002, a water sample from Seas Branch Pond was collected. A 1+ inch rainfall event had occurred in the previous 24 hours. The sample was collected mid-lake using a 6-ft. depth integrated sampler. Sampling was repeated on September 7, 2004 without the influence of a recent rainfall event. Stream samples were also collected above and below the pond in 2004. Results are found in Table 1.

Table 1. Seas Branch Pond Water Chemistry

Seas Branch Pond Water Chemistry Results		Aug. 13, 2002	Sept. 7, 2004	Average WI**	Above Pond Sept. 7, 2004	Below Pond Sept. 7, 2004
Chlorophyll A, fluorescence (µg/l)		22.7	27.3	23	1.29	5.43
Total Nitrogen*	(mg/l)	3.5	3.2	1.0	4.54	2.34
Total Phosphorus	(µg/l)	345	51	65	51	40
Suspended Solids	(mg/l)	26	9		2	6
Water Temperature	(°C)	21.8	18.9		10.2	15.8
pH		8.8	8.7	7.5	8.1	
Dissolved Oxygen	(mg/l)	14.4	11.5		10.7	

* Total N is sum of ammonia, nitrite, nitrate, and Kjeldahl nitrogen

** Average Wisconsin Impoundment per Lillie and Mason, 1983.

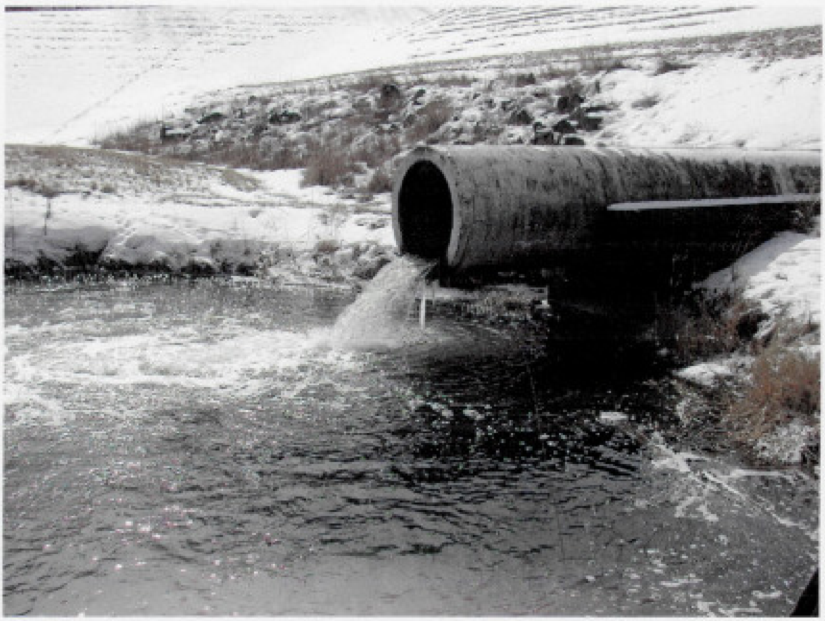

Figure 5. Seas Branch Pond outlet to Seas Branch, March 6, 2003 (WDNR)

Phosphorus

In more than 80% of Wisconsin's lakes, phosphorus is the most important nutrient affecting the amount of algae and weed growth. Ideally, concentrations of total phosphorus less than 30 µg/l (parts per billion) must be maintained in impoundments to prevent nuisance algae blooms. However, the average phosphorus concentration found in Wisconsin impoundments is more than double that at 65 µg/l. In general, impoundments with largely agricultural watersheds are plagued with nuisance algae blooms around the state. The phosphorus level of 345 µg/l documented in August 2002 is ten times greater than that suggested to prevent algae blooms. However, this sample was collected on the heals of a major rainfall the previous 24 hours. This high phosphorus concentration is not indicative of normal phosphorus levels found in Seas Branch Pond, but it does illustrate the pulse of phosphorus entering the impoundment after a rain event. The 2004 sample was collected during a dry period in September with no influence from recent rainfalls. The sample concentration of 51 μg/l reflects a baseline level of total phosphorus in Seas Branch Pond, which is above the ideal concentration of 30 μg/l to prevent nuisance algae blooms, yet better than the average Wisconsin impoundment. Two samples are not adequate to draw definitive conclusions about phosphorus concentrations in Seas Branch Pond, but they do indicate conditions that can lead to water quality clarity problems due to algae blooms in the pond.

Table 2. Phosphorus concentrations and corresponding water quality index (Lillie and Mason, 1983).

Phosphorus (ug/l)	Water Quality Index
<1.0	Excellent
1-10	Very Good
10-30	Good
30-50	Fair
50-150	Poor
>150	Very Poor

Nitrogen

Nitrogen is second only to phosphorus as a key nutrient for plant and algae growth. Nitrogen is introduced to Seas Branch Pond from rainwater, groundwater, and surface runoff. In about 10% of Wisconsin's lakes, nitrogen rather than phosphorus limits algae growth. Seas Branch Pond does not fall in that category since the ratio of nitrogen to phosphorus is 62:1 under normal flow conditions. A nitrogen limited lake contains N:P ratios of 10:1 or less. Nevertheless, inorganic nitrogen levels above 0.3 mg/l can also contribute to nuisance algae blooms. Seas Branch Pond contains nearly 10 times that amount of inorganic nitrogen (2.7 mg/l in 2002 and 2.4 mg/l in 2004). The average Wisconsin impoundment (1 mg/l) also exceeds the target 0.3 mg/l concentration.

Chlorophyll

Chlorophyll is a measurement of algae biomass that is suspended in water. At high concentrations, it can make the water appear green or turbid. The chlorophyll values found in Seas Branch Pond (22.7 and 27.3 μg/l) indicate poor water quality. The average Wisconsin impoundment chlorophyll concentration of 23 μg/l also falls into the poor water quality index category.

Table 3. Cholorphyll and corresponding water quality index (Lillie and Mason, 1983).

Chlorophyll (ug/l)	Water Quality Index
<1	Excellent
1-5	Very Good
5-10	Good
10-15	Fair
15-30	Poor
>30	Very Poor

Secchi Depth

Secchi depth is a measure of water clarity and serves as an indicator of the lake's overall health. A Secchi reading is taken with a black and white disc, which is lowered into the water until it just disappears and then raised until just visible. The Secchi depth varies throughout the summer as levels of algae or suspended particulate matter increase or decrease. Secchi readings taken weekly or biweekly are an excellent way to document long-term changes in water clarity. At low flow, algae is the most frequent cause of low Secchi disc readings in Wisconsin. Sixteen Secchi depth readings taken between May and October 2002 averaged 3.5 feet. This average depth rates poor on the Secchi depth water quality index scale. A single reading of 2.75 feet in September 2004 rates very poor. However, Seas Branch Pond is only on average 6 feet deep. So the average Secchi depth of 3.5 feet means the disc was visible to greater than half the depth of the pond (See Figure 6).

Table 4. Secchi depth and corresponding water quality index (Lillie and Mason, 1983).

Secchi Depth (feet)	Water Quality Index
>20	Excellent
10-20	Very Good
6.5-10	Good
5-6.5	Fair
3.25-5	Poor
<3.25	Very Poor

Seas Branch Water Chemistry Above and Below the Pond

Water samples were taken immediately upstream of Seas Branch Pond and downstream near the mouth of Seas Branch on the same day the pond was sampled in September 2004 (see Figure 8). Nutrient values were similar above, below and in the pond; however the water temperature, suspended solids and chorophyll levels were lower above the pond than concentrations documented both in the pond and further downstream (Table 1). The water chemistry samples illustrate that the water clarity does not improve below the pond for at least two miles, the distance of the downstream sample.

Seas Branch Pond Sediment Chemistry

On March 6, 2003, a single 2”diameter by 12” deep sediment core was collected from Seas Branch Pond. The sediment core was composited for analysis. The core was obtained mid-lake, away from the influence of the Seas Branch stream channel (Figure 7). The sediment chemistry results are found in Table 5.

Table 5. Seas Branch Pond Sediment Chemistry

Seas Branch Pond Sediment Chemistry Results		Average Western Wisconsin Impoundment*	
Arsenic	10	6.8	mg/kg
Nitrogen NH3-N	106	75	mg/kg
Total Phosphorus	806	480	mg/kg
% sand	36	55	
% silt/clay	64	45	

* Western District sediment data in ppm (mg/kg or ug/g) dry weight (excluding Mississippi River). Spreadsheet maintained in Eau Claire Regional DNR office.

Total phosphorus in sediments is highly influenced by particle size of the sediment. The smaller the sediment size, the greater the total phosphorus. The 64% silt and clay in the sample indicates the impoundment efficiently traps fine sediment. The phosphorus concentration found in Seas Branch Pond sediment is nearly twice the average concentration found in Western Wisconsin impoundments. Nuisance algae blooms in Seas Branch Pond are fed by phosphorus dissolved in the water column and phosphorus available from the sediment to be dissolved. The source of the phosphorus in the sediment was not determined, but runoff from agricultural lands may represent a major source. The shallow depth of the pond (average depth, 6.1 feet) coupled with the east-west orientation of the pond contributes to effective mixing when westerly winds prevail. The narrow valley funnels westerly winds across the pond enabling mixing and re-suspension of phosphorus laden sediments.

Figure 7. Sediment core from Seas Branch Pond March 6, 2003. (WDNR)

The arsenic concentration is indicative of native soil concentrations found in western Wisconsin. A number of variables, which were not measured in Seas Branch Pond, lead to difficulties in trying to extrapolate bulk sediment ammonia concentrations to actual exposure levels of solubilized un-ionized ammonia to benthic, epibenthic, and pelagic organisms. Only a comparison of Seas Branch ammonia levels to the average of other Western Wisconsin impoundments can be made at this time. The Seas Branch Pond sediment contained slightly higher ammonia levels than the average Western Wisconsin impoundment.

Seas Branch Fish Surveys

In 1997, a total of five stations were electrofished in Seas Branch. All stations were located downstream of the impoundment (see Figure 8). All five stations contained abundant brown trout representing several year classes (Table 6). Brown trout ranged in size from 2 to 20 inches. Other species present during the 1997 survey include white sucker, mottled sculpin, fantail darter, johnny darter, longnose dace, blacknose dace, American brook lamprey, common shiner, creek chub, brook stickleback, bluntnose minnow, bluegill, and green sunfish. Extrapolating from the numbers of trout collected over five stations in 1997, Seas Branch downstream of the pond supported 1,640 trout per mile of stream. As a result of the 1997 survey, the portion of Seas Branch downstream of Seas Branch Pond was reclassified from a Class II to a

Class I trout stream (WDNR, 2000). A Class I trout stream contains self sustaining populations of trout which do not require stocking.

The stream was surveyed again in September 2002 to determine the fish population immediately downstream of the impoundment. Station 5 from the 1997 survey was electrofished in 2002 and a total of 536 brown trout and 9 brook trout were captured (WDNR, 2002). The same station was electrofished in September 2004. Reduced numbers of both brown trout (146) and brook trout (7) were collected compared to previous years (figures 9, 10, 11, and 12). Annual sampling of other trout streams indicate that recruitment levels were depressed in many southwest Wisconsin trout streams in 2004 due to the 2003 drought combined with the high flows in early spring 2004. The 2004 Seas Branch data corroborates that observation.

Table 6. Seas Branch Below Seas Branch Pond Electrofishing Data

Seas Branch Below Impoundment		1997					2002	2004
	Station #	1	2	3	4	5	5	5
Brown Trout	Fingerling	287	99	118	173	200	404	80
	Yearling	45	254	80	18	8	64	42
	Adult	4	10	7	5	0	68	24
Brook Trout	Fingerling	1	0	0	0	0	6	2
	Yearling	0	0	0	0	0	2	4
	Fingerling	0	0	0	0	0	1	1

Seas Branch Macroinvertebrates

Macroinvertebrate samples were collected with a kicknet from riffles in Seas Branch at three locations in May and October of 1997. The samples were collected upstream of Seas Branch Pond, immediately below the pond and further downstream near the mouth (see Figure 13). A representative sample (minimum 100 insects) of the collected macroinvertebrate sample was identified to species at the UW-Stevens Point Entomology Lab. The Hilsenhoff Biotic Index (HBI), a measure of organic pollution, was calculated for each sample. The HBI values indicate some organic pollution immediately below the pond, but the stream recovers from the organic pollution further downstream (Table 7). The organic pollution in Seas Branch is likely the oxygen demand of decomposing algae originating in the impoundment.

Table 7. HBI Values for Seas Branch

Location	May 22, 1997		October 9, 1997	
Lower	4.1	Very Good	3.7	Very Good
Middle	5.5	Good	4.8	Good
Upper	1.9	Excellent	1.4	Excellent

The sampling technique and the identification sub-sampling procedures do not allow a measure of macroinvertebrate biomass, only a relative abundance of each species based on the representative sub-sample. Grouping of the Seas Branch aquatic invertebrate species into their respective orders illustrates the significant differences in prevalent families from upstream to downstream (Figure 14). The upstream site is dominated by Ephemeroptera (mayflies) and Trichoptera (caddisflies). While the site immediately below the pond is dominated by Diptera (true flies), Amphipoda (crustaceans) and Trichoptera. Further downstream the prevalent families shift to Trichoptera and Coleoptera (beetles).

Seas Branch Continuous Water Temperature

Continuous temperature loggers (Onset Corporation – Stowaway Tidbit) were deployed in Seas Branch at three locations above and below the pond since fall 1997 (Figure 15). The units were attached to iron plates with coated cable and submerged in-stream. Temperature was recorded hourly. Some gaps in the seven year record were due to either loss of logger or battery malfunction.

The hourly data can be analyzed in a variety of ways. For this report, monthly average temperatures were compared between sites as well as a frequency analysis of data collected throughout the summer months. A variety of climactic conditions existed throughout the seven year monitoring period, and yet the monthly average temperature differences between the three sites remained consistent (Figures 16 through 22). The upstream site was consistently colder during summer months and warmer during winter months compared to the two downstream sites. These data reflect a portion of stream heavily influenced by groundwater. In fact, the Crume spring is only one quarter mile upstream of the temperature monitoring equipment at the upper sampling site.

The temperature logger immediately downstream of Seas Branch Pond consistently recorded the warmest summer monthly average temperatures for the stream. The data collected further downstream of the pond near the mouth indicates the stream cools down on average between 5-7°F, but does not approach the colder temperatures found upstream of the pond. Approximately seven small spring-fed tributaries enter Seas Branch between the pond and the mouth.

A frequency analysis of the summer only data (June-August) for 1998 and 2003 was also completed. The number of hourly data points by degrees Fahrenheit was calculated. A difference of greater than 10°F between the dominant temperatures near the spring (51°F) and below the pond (63° to 65°F) was documented in 1998 and 2003.

Seas Branch Pond Continuous Water Temperature

A temperature depth profile was not collected, however continuous temperature loggers were suspended near the surface and the bottom of the pond for one year (September 2002-September 2003). One pair of loggers was anchored near the road side of the pond, away from any influence of the stream (Figure 25). The other pair of loggers was anchored near the bluff in the zone influenced by the stream. An average of 5°F difference from surface to bottom was recorded for the summer months (June-August) at both locations (bluffside and roadside). However, the pond did not exhibit a temperature gradation from north (near the road) to south (near the bluff) in the summer of 2003 (Figure 26). A lake which stratifies in the summer would have a much greater temperature difference between the surface and bottom. True stratification of Seas Branch Pond may occur in some summers under certain conditions, but it did not occur in the summer of 2003, which was a drier than normal year.

The pond is oriented longitudinally in an east-west direction with the Seas Branch stream thread running from west to east in the southern portion of the lake against the bluff. The east-west orientation of Seas Branch Pond increases the likelihood that wind fetch hinders the six foot deep pond from thermal stratification.

Discussion

<u>Existing Conditions</u>

Seas Branch Pond is functioning as designed – an impoundment to reduce flood flows and trap sediment. The pond has not been dredged since it was created in 1966. The life expectancy of an impoundment depends on many factors: sediment load, frequency and magnitude of rainfall events, as well as size and land cover of the watershed. After 38 years of life, Seas Branch Pond has become a shallow lake with uniform depth and frequent algae blooms. Nutrients (nitrogen and phosphorus) entering the pond are utilized by the resident algae population. Algae blooms are present throughout much of the summer. The pond also acts as a solar sink which effectively warms the water temperature. The pond discharges warmer water laden with algae to downstream Seas Branch.

Seas Branch is a Class I trout stream for its entire length, meaning the population is sustained by natural reproduction and no stocking is required. A statewide study to test the hypothesis that native brook trout communities can be re-established in portions of their historical range by removing introduced salmonids (brown and rainbow trout) using electrofishing gear was conducted by the WDNR. Seas Branch was chosen as a study site since the dam that creates Seas Branch Pond is a barrier to upstream travel of fish. In 1997, that effort began on Seas Branch with removal of brown trout above the dam in order to establish a wild brook trout population with a total of 4,867 brown trout removed from above the pond and released downstream of the pond (Avery, 1999). A catch and release fishing regulation on Seas Branch above the dam coupled with limited competition from brown trout allowed the brook trout population to flourish and remain strong with natural reproduction. The condition of the brown trout fishery below the dam was not as intensively studied over the same time period; however, the limited sampling indicates that despite the increased water temperatures and suspended algae, the Class I brown trout population below the pond naturally reproduces and contains abundant numbers of fish.

The macroinvertebrate community downstream of the pond is drastically different from the upstream community. This change in community structure is likely influenced by a combination of increased water temperatures, suspended algae and some biological oxygen demand (BOD) from decomposing algae, all originating in the pond. Since nearly 70% of the stream bottom downstream of the pond is comprised of rubble and gravel, substrate is not limiting the macroinvertebrate population below the pond (WDNR, 1997). The macroinvertebrate data does not indicate the pond significantly impacts the stream since species which are very tolerant to high organic loads were not present downstream of the pond. However, the Hilsenhoff Biotic Index (HBI) scores for Seas Branch samples indicate the presence of organic pollution below the pond. That organic pollution is decomposing algae and plants found in the pond. Further analysis of the samples indicate a predominance of mayfly species above the pond, caddisfly and dipteran species immediately below the pond and a shift to primarily caddisfly further downstream. All three orders were found in all locations but in different densities. The shift in predominant insect species in the upstream to downstream continuum can be explained by the presence of the pond. The dipteran and caddisfly species found immediately below the pond are primarily filter feeders. The abundance of suspended particles, seen as cloudy water to the naked eye, is filtered by the aquatic insects for food. The predominance of mayfly species found upstream of the pond tend to collect, gather and shred their food which comes in the form of fallen leaves or vegetation found in the stream. The presence of abundant brown trout below the pond indicate they are effectively utilizing the existing macroinvertebrate community as a food base, especially young brown trout.

Nutrient levels in Seas Branch Pond sediment are higher than the average Western Wisconsin impoundment, however the amount of phosphorus available to the water column is unknown. Phosphorus is more likely to migrate to the water column as dissolved P under anoxic conditions or high pH levels (>9.5). Since there is no evidence of thermal stratification in the pond, anoxic conditions at the sediment water interface are not suspected at this time. Dissolved P was not measured. Future sampling, if warranted, should include dissolved P above, within and below the pond.

Future Conditions

Scenario 1 – Pond persists with no management changes

If Seas Branch Pond remains with no changes in management, the increased stream temperatures and decreased water clarity downstream in Seas Branch will persist. The macroinvertebrate species composition and relative abundance would not change significantly from what was observed in 1997. The fish community would also persist with abundant food, cover and spawning riffles with fluctuations in population dynamics influenced mainly by climactic and flow conditions. Algae blooms in the pond would continue to be evident for much of the summer. The pond would continue to fill in with sediment eventually becoming a wetland with a braided channel.

Scenario 2 – Dredge pond and manage as a wet dam

If Seas Branch Pond were drained and dredged down to parent material in order to deepen the lake, the phosphorus available in the sediment would presumably be reduced. Reduction of sediment phosphorus concentrations may reduce the length or frequency of algae blooms. Agricultural land today still contributes nutrient rich soil to Seas Branch. However the amount may be far less than that of nearly 40 years ago when the dam was first constructed. Over time, the lake will fill in with sediment again, but the length of time before a subsequent dredging would be needed is unknown.

A deeper lake with decreased phosphorus concentrations in sediments may decrease the length and frequency of algae blooms due to less availability of phosphorus. Residence time in the lake would increase with a deeper lake, which may negate the benefits of decreased phosphorus in the sediment because the water would be in contact with the sediments for a longer period of time. If the pond is dredged deep enough to stratify, then phosphorus may be released into the hypolimnion (lower lake strata) if it became anoxic. Release of deeper phosphorus rich water into the epilimnion (upper lake strata) for use by algae would occur at turnover in the fall and spring or any other mixing events, including by wind. But as the pond fills in over time, the likelihood of algae problems would increase due to more frequent lake mixing. It is unknown whether Seas Branch Pond could be dredged deep enough to stratify. Dissolved phosphorus entering the lake via Seas Branch may be enough to support nuisance algae blooms despite a deeper lake.

If the lake is deepened by dredging, the water temperature downstream may become cooler, but only if the lake is deep enough to stratify. Since Seas Branch Pond has a bottom draw water control structure, colder denser water from the lake's bottom would be discharged. However if the became anoxic, low dissolved oxygen levels would also be discharged with a possibility of stress to the downstream fish and macroinvertebrate community.

If dredging resulted in fewer algae blooms and decreased water temperatures, the downstream biota would be affected by clearer, colder water. The macroinvertebrate community may more closely resemble the upstream community. The brown trout may be negatively affected by the colder water temperatures that fall outside the range for optimal growth. Responses such as smaller and thinner brown trout would be expected. Conversely, the small brook trout population found below the pond would thrive and expand in colder water temperatures.

Dredging of Seas Branch Pond would require acquisition of all permits required for such an undertaking. Disposal of dredge spoils would also need approval.

Scenario 3 – Isolate the Seas Branch channel from the pond during normal flow

If the Seas Branch stream thread were isolated from the remaining area of impounded water during normal flows, many downstream changes would be expected. The uninterrupted flow of Seas Branch through the pond would decrease downstream water temperatures and increase water clarity.

Expected changes in biota downstream of the dam include a macroinvertebrate community that more closely resembles the upstream community with a predominance of mayflies. Colder water temperatures would favor brook trout over brown trout. Consequently the brown trout population downstream of the pond may decrease in number, while the brook trout population would be expected to increase in number. Tempering that prediction is the fact that brown trout are more piscivorous than brook trout in the adult stage which means the brown trout may out-compete the brook trout for food and space in the same stream. However, Seas Branch brown trout may seek out streams with a temperature regime closer to their liking such as the downstream waterbody, the West Fork of the Kickapoo River.

Successfully isolating the stream from the pond would involve temporarily draining the pond coupled with the strategic placement of soil and rock. Permits would be required to place material in the bed of a pond. In keeping with the purpose of the flood control dam, any embankment must be designed to allow high flow events to easily overtop the embankment to allow for storage of excess runoff. If the embankment is designed correctly, the sediment laden runoff should settle out of the water column in the impounded area. Yet, during normal flow, the stream would flow through the dam bypassing the impounded water.

Scenario 4 – Drain and operate as a dry dam

If the Seas Branch Pond dam were operated as a dry dam, the temporary impoundment of water would only occur during high flow events. The water temperature would decrease and the water clarity would increase. The macroinvertebrate community would more closely resemble the upstream community. Brook trout may replace brown trout, or at the very least increase in population size. Re-vegetation of the former lake bed would be important to keep the lake bed soils from migrating downstream during high flow events.

Regardless which management scenario for Seas Branch Pond is chosen, the biotic community downstream of the pond will adapt. The fish and macroinvertebrates downstream of the pond have already adapted to the current conditions. In fact, some macroinvertebrate species even flourish in the current conditions. If the water were to become colder and clearer, the macroinvertebrate community and fish community would acclimate over time. These changes would include an increase in some species and a decrease in other species.

Further Study

If management scenario 2, 3 or 4 is chosen, water temperature, fish surveys, macroinvertebrate surveys and water chemistry should be collected in Seas Branch to document changes. If the pond is dredged or modified in some way, additional sampling of total and dissolved phosphorus is recommended. If the pond is drained, a slow drawdown is recommended to minimize movement of sediment downstream. Seeding of exposed sediments should be completed as soon as possible after the drawdown is complete. Contents of the seed mix would be determined from the existing seed bank in the pond sediments as well as management objectives for the riparian land.

A second P.L. 566 structure in the Seas Branch watershed creates an impoundment called Hidden Valley Lake. It is 17 acres in size with a five square mile watershed, similar to Seas Branch Pond. However, the land cover in the watershed contains more agriculture and less forest (87% agriculture, 11% forest, and 2% urban) than the Seas Branch watershed. The outlet of Hidden Valley Lake is one mile upstream of Seas Branch. This tributary enters Seas Branch 1,600 feet downstream of the Seas Branch outlet. Since both impoundments discharge to lower Seas Branch, the increased water temperatures and decreased water clarity may be compounded by discharge from Hidden Valley Lake as well. Virtually nothing is known about this impoundment. Hidden Valley Lake and its outlet tributary should be studied, including at a minimum water temperature, thermal profiles, fishery, macroinvertebrates, Secchi depth, chlorophyl and nutrients. If Hidden Valley Lake has water quality conditions similar to Seas Branch Pond, management scenarios must be considered here as well.

References

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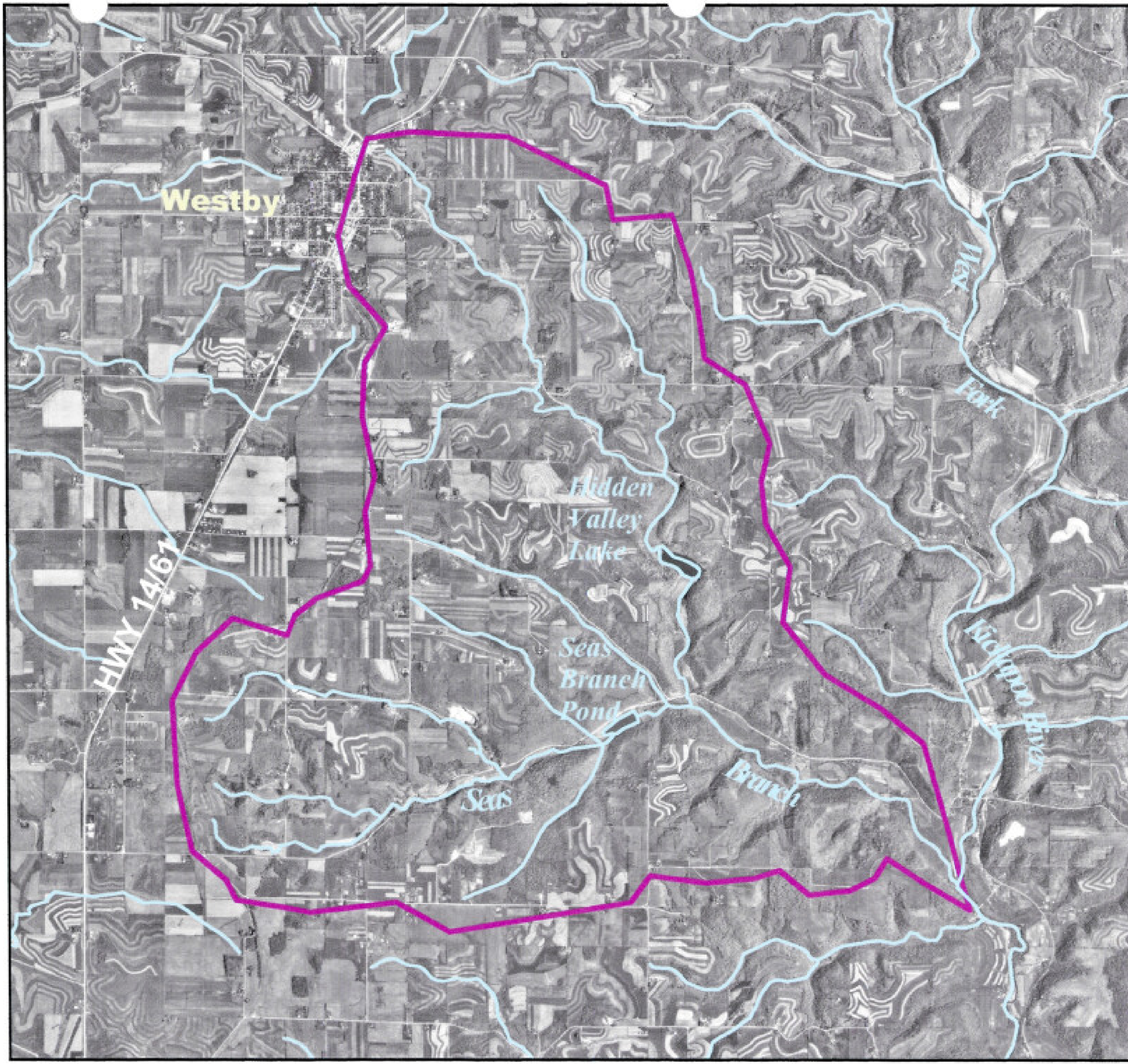
WDNR. Ongoing. Western District Sediment Data in ppm Excluding Mississippi River. Excel spreadsheet maintained in DNR West Central Regional office in Eau Claire.

Figure 3.
Seas Branch Watershed (14 sq. mi.)
1995 Aerial Photo



Rivers/Streams
Seas Branch Watershed

N

0 0.5 1 Miles

1:55000

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Map Creator: C. Koperski

December 9, 2004

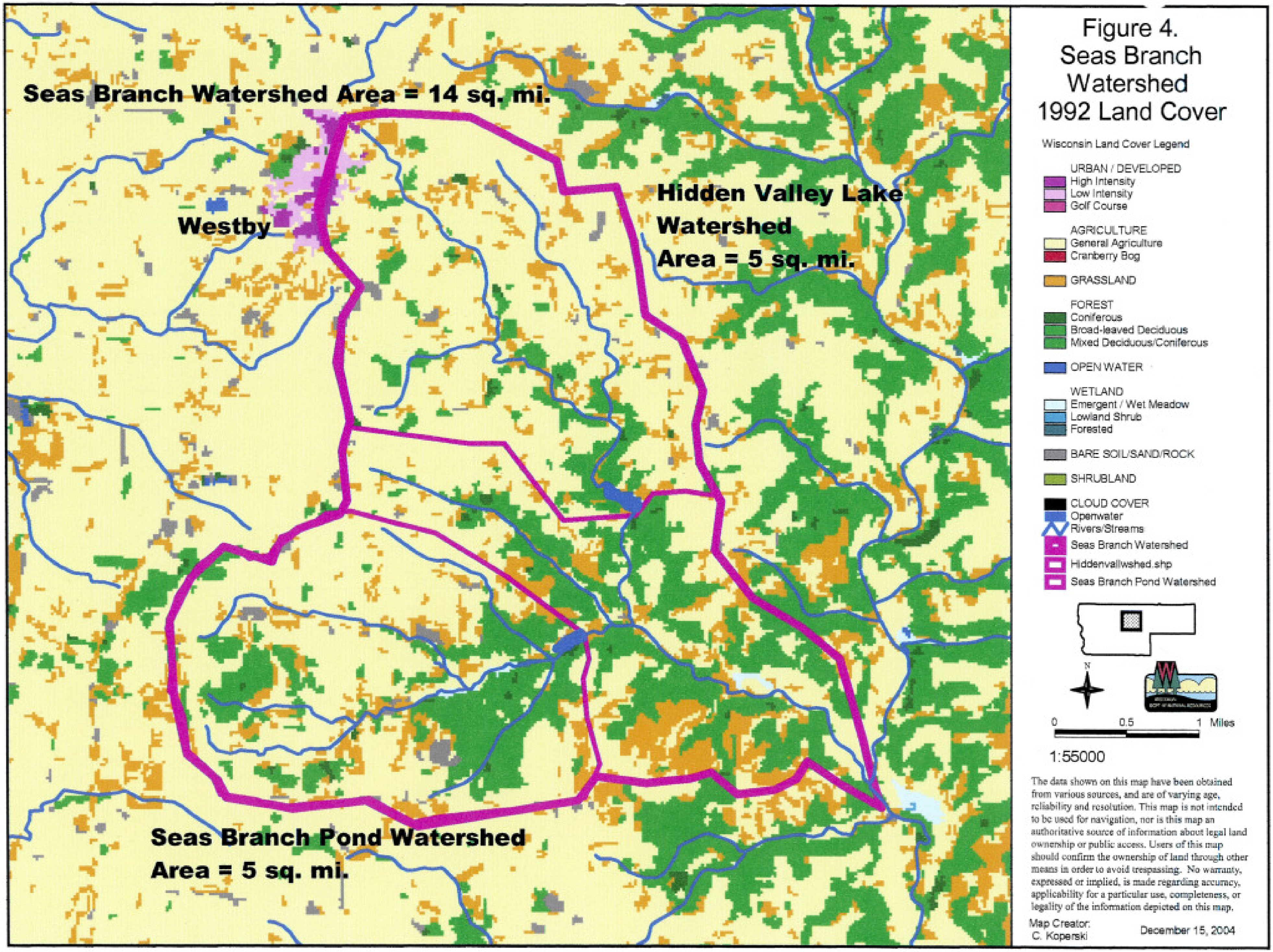
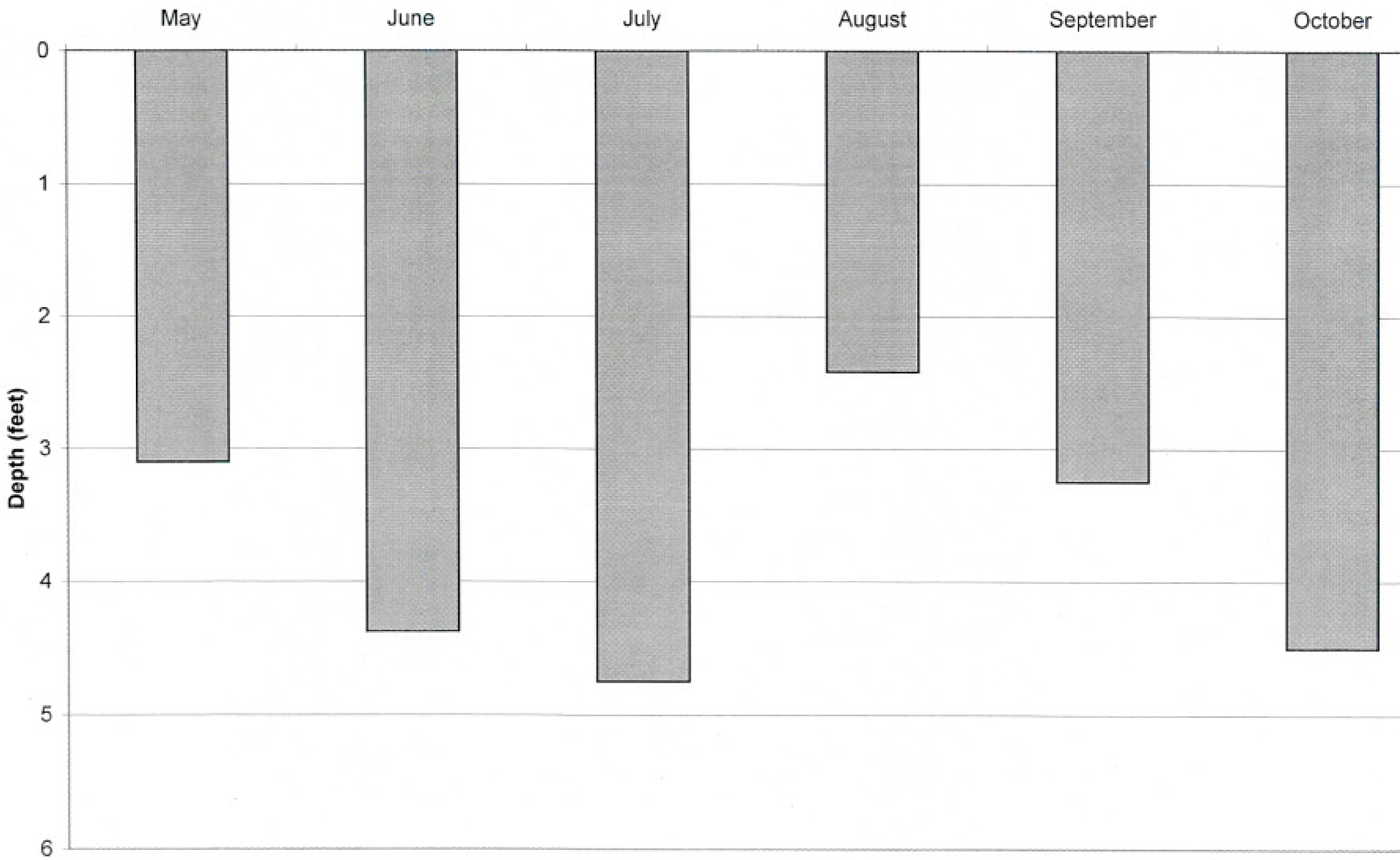


Figure 4. Seas Branch Watershed 1992 Land Cover

Figure 6. Seas Branch Pond
Secchi Readings, 2002



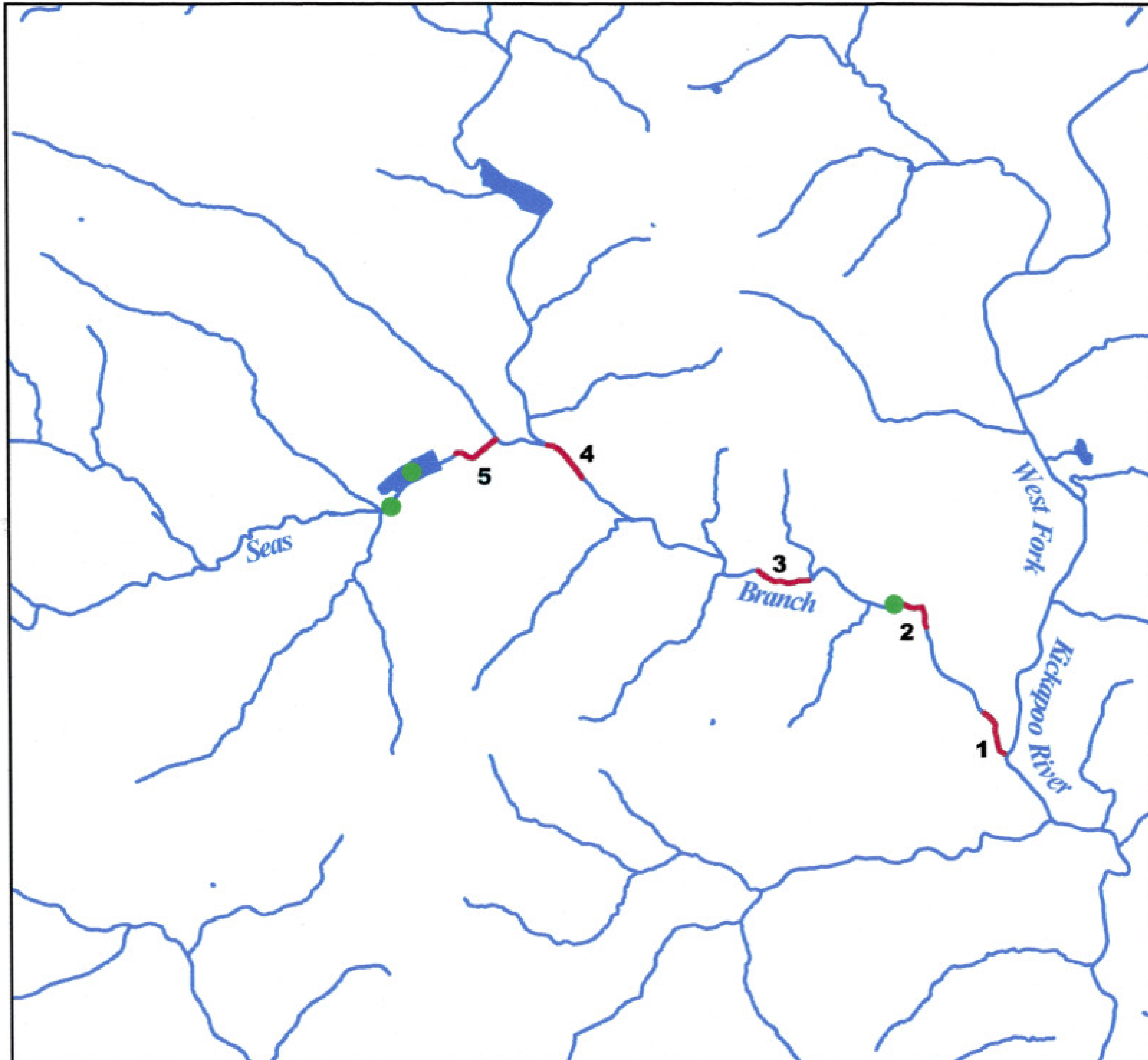


Figure 8. Fish Stations 1-5 in 1997 5 in 2002 & 2004

Water Chemistry 2002 & 2004

Water Chemistry Samples
Fish Survey Stations
24K Rivers and Streams
Perennial
Intermittent
Shoreline
24K Open Water

0 0.5 Miles

1:32000

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December 9, 2004

Figure 9. Seas Branch Brown Trout Immediately Below Impoundment (Station #5)

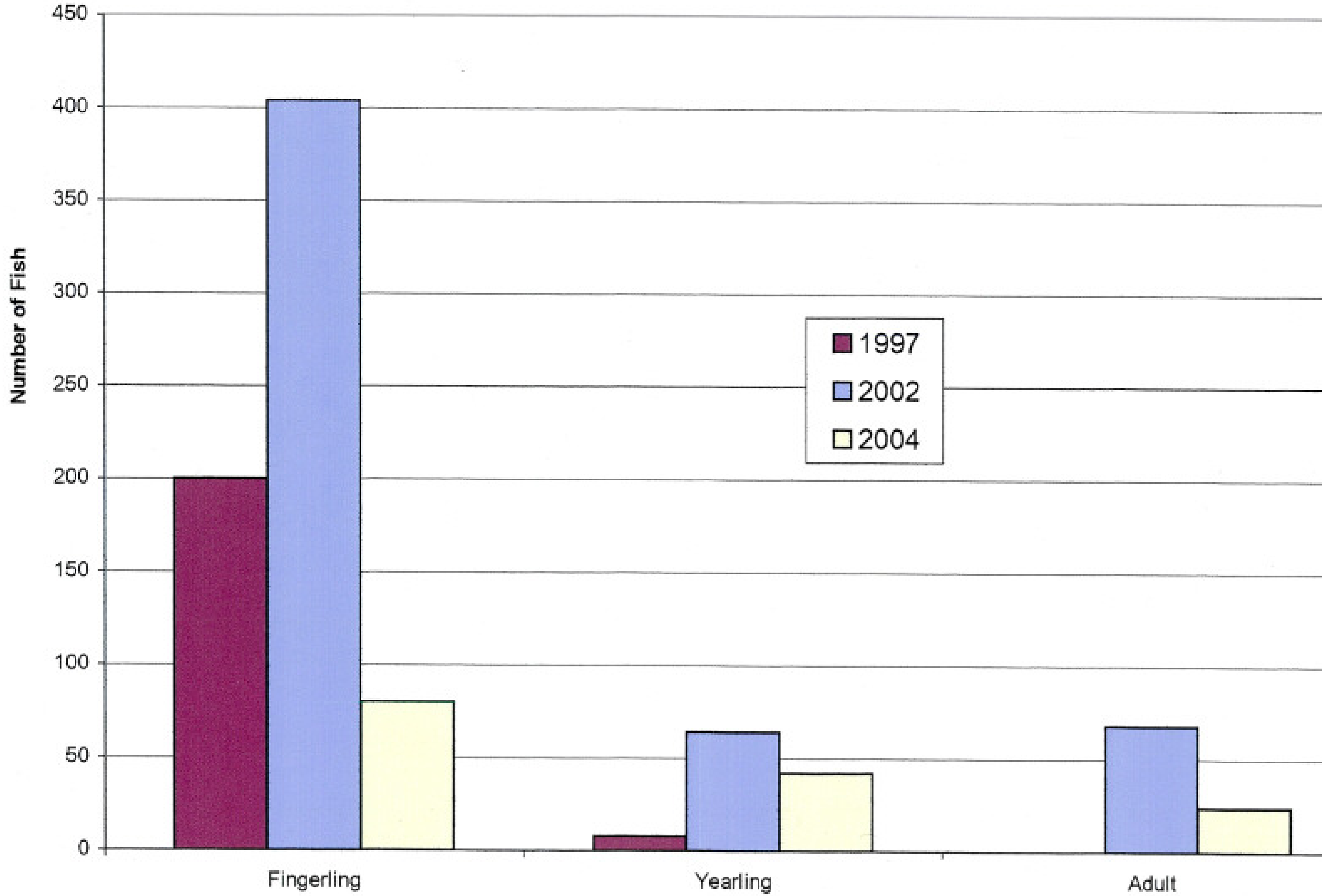
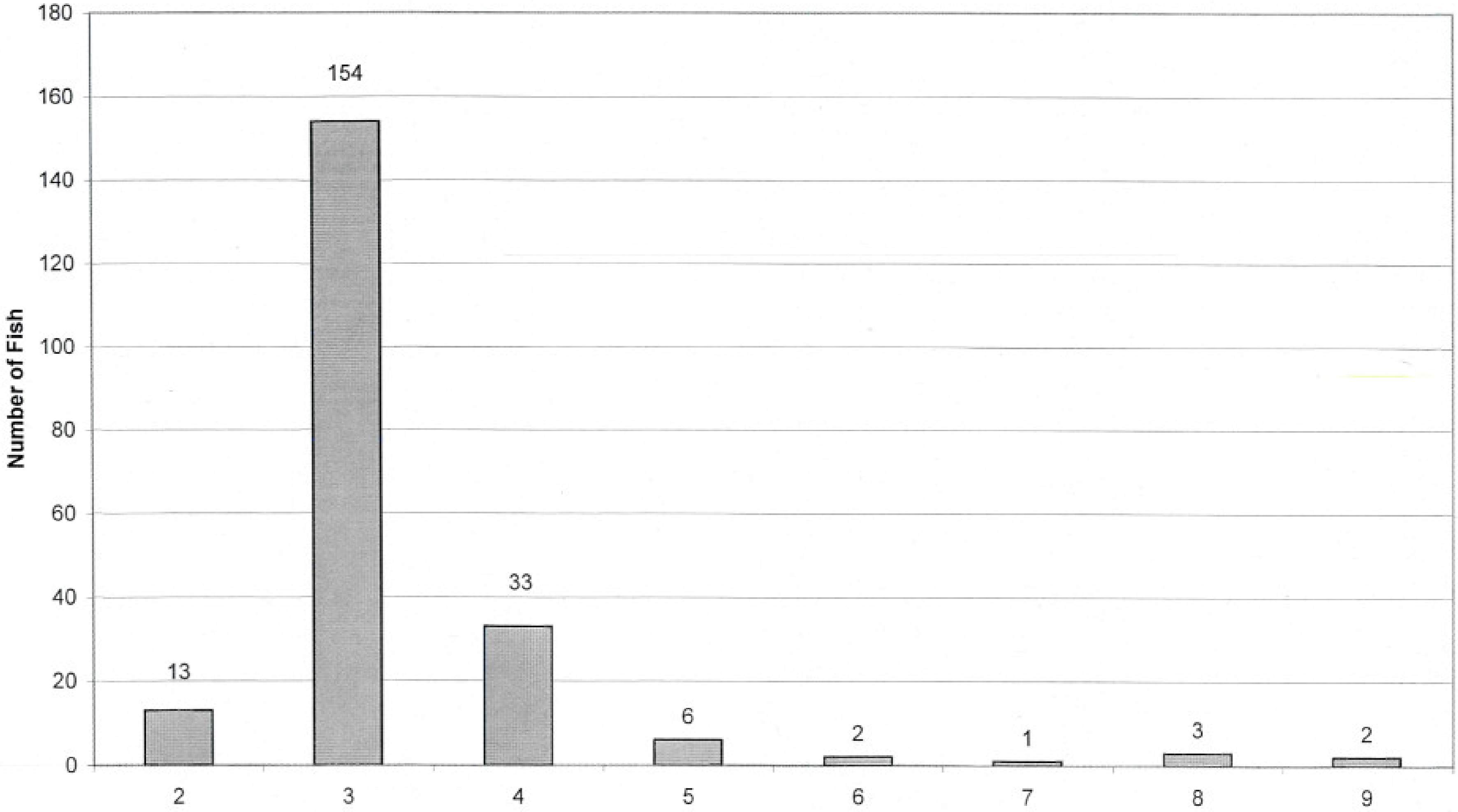


Figure 10. Seas Branch Brown Trout Below Impoundment - 1997
(Station #5)



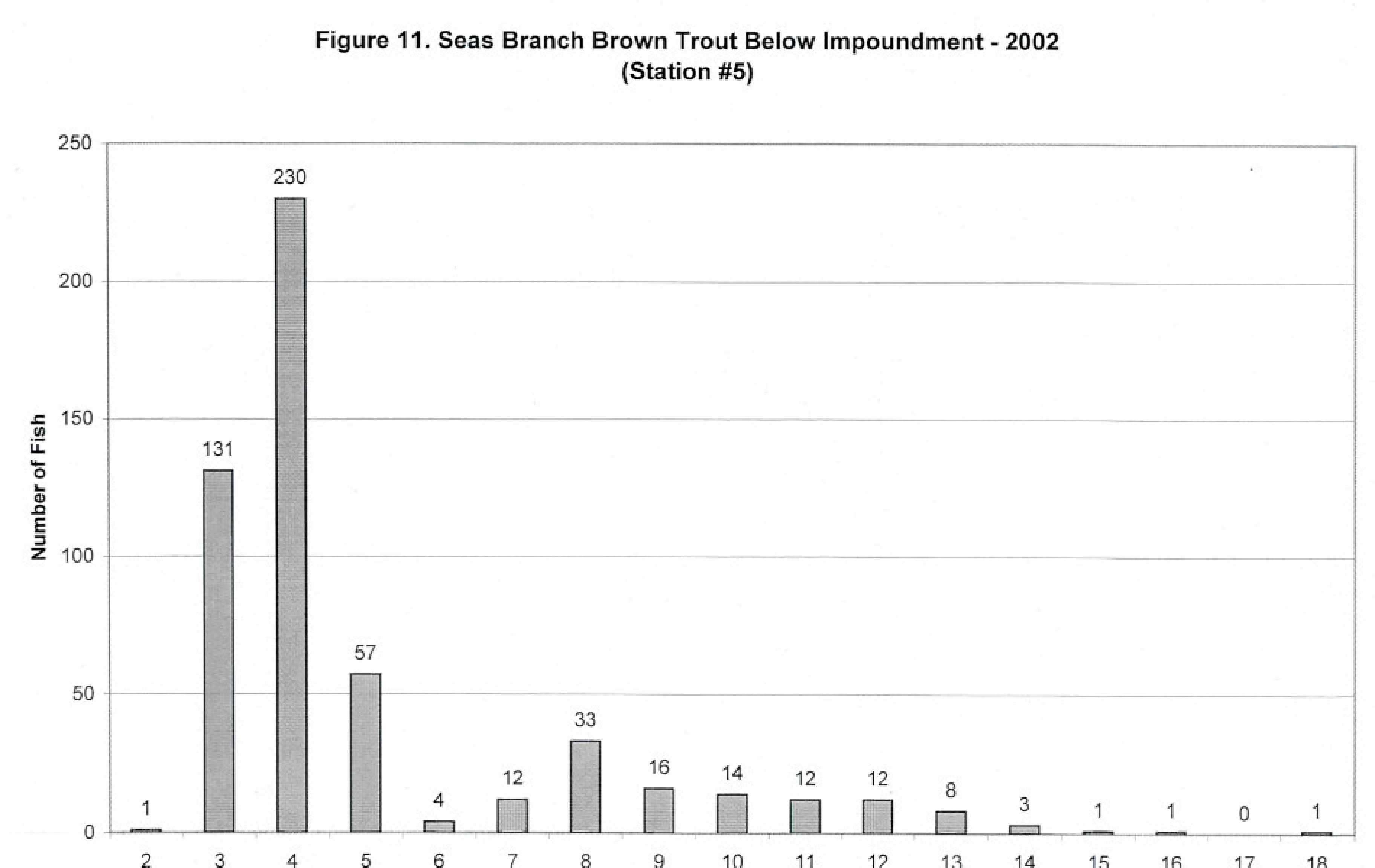
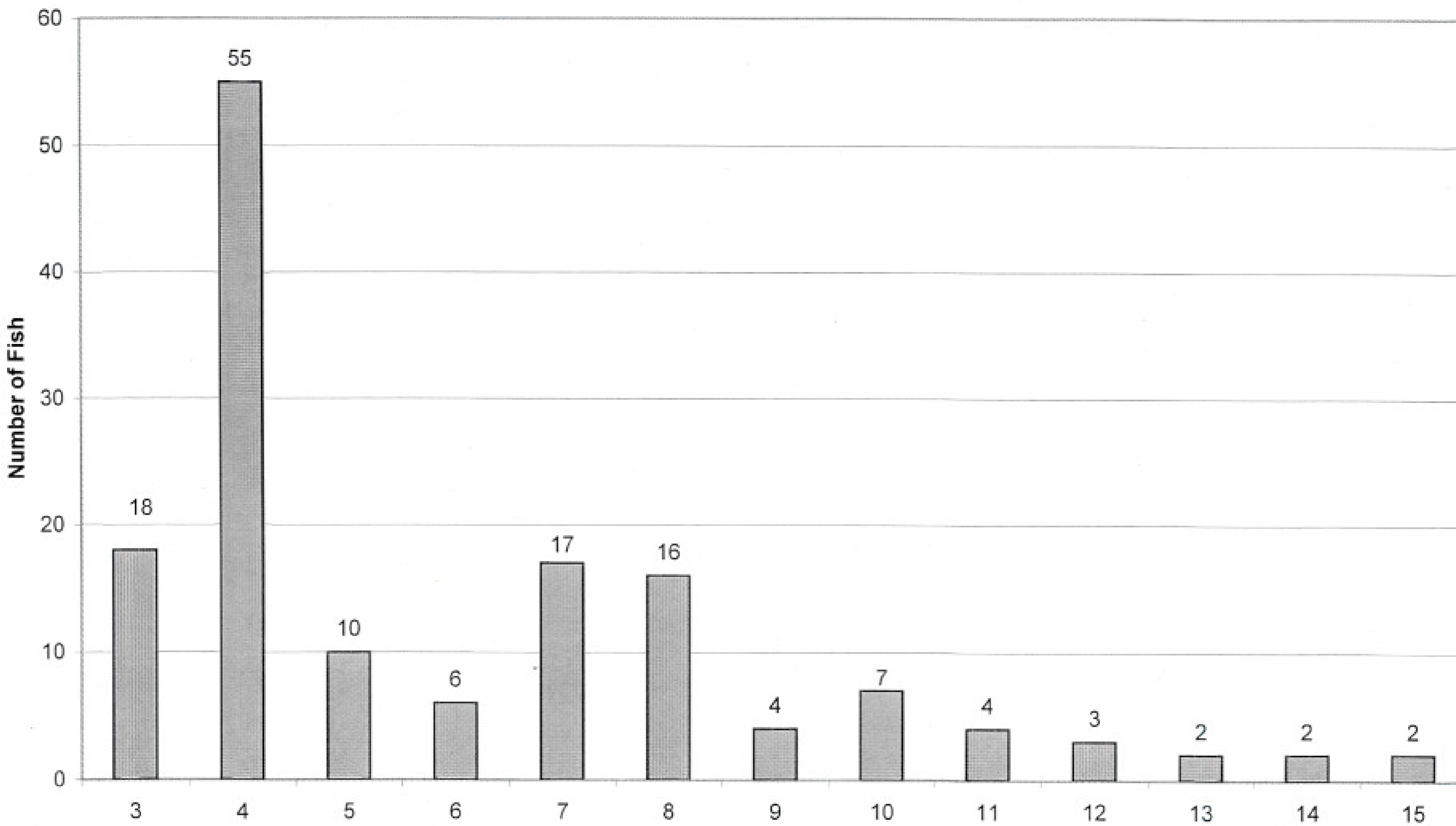


Figure 11. Seas Branch Brown Trout Below Impoundment - 2002
(Station #5)
250
200
150
100
50
0
Number of Fish
1
131
230
57
4
12
33
16
14
12
12
8
3
1
1
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18

Figure 12. Seas Branch Brown Trout Below Impoundment - 2004
(Station #5)



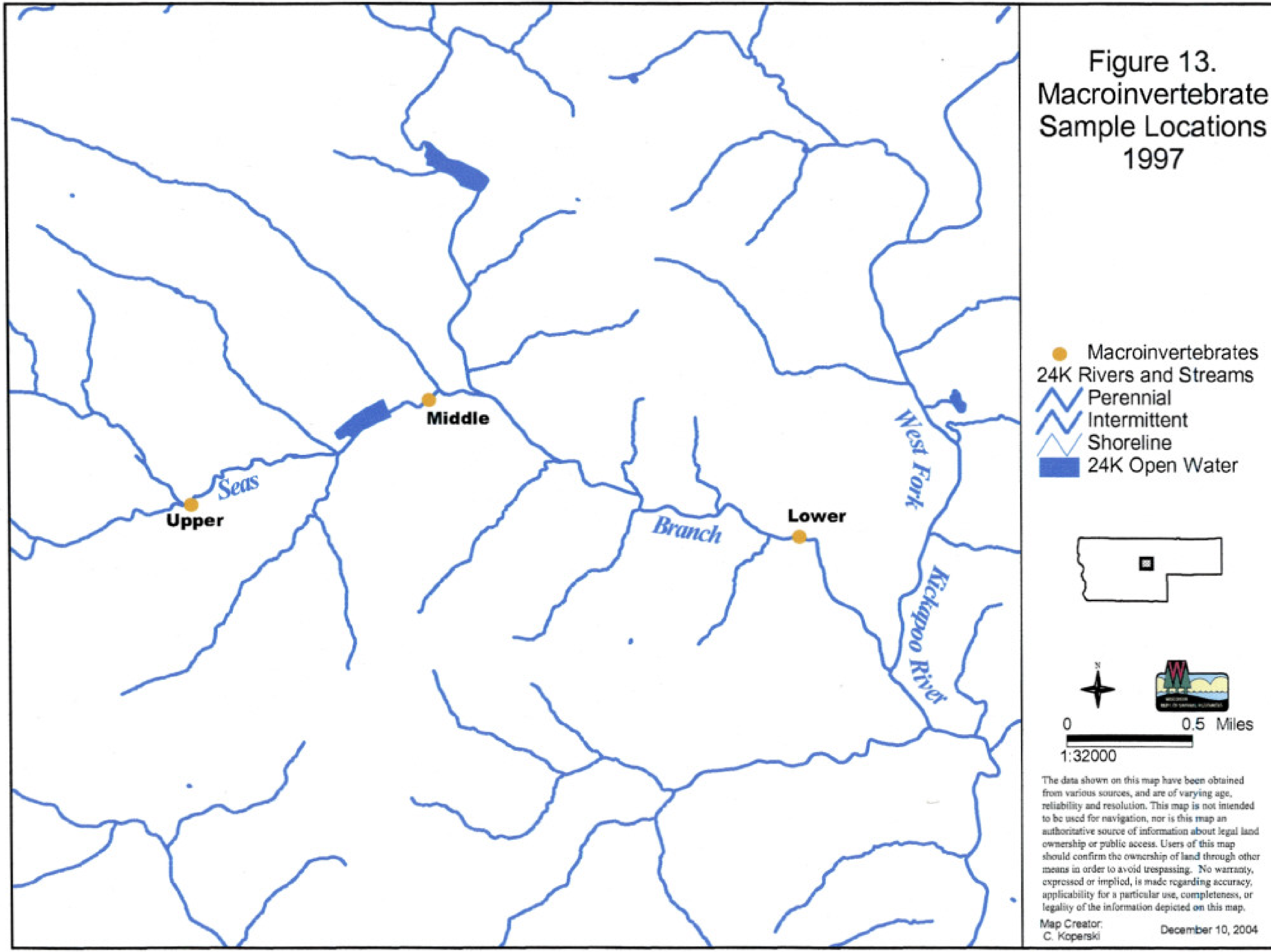
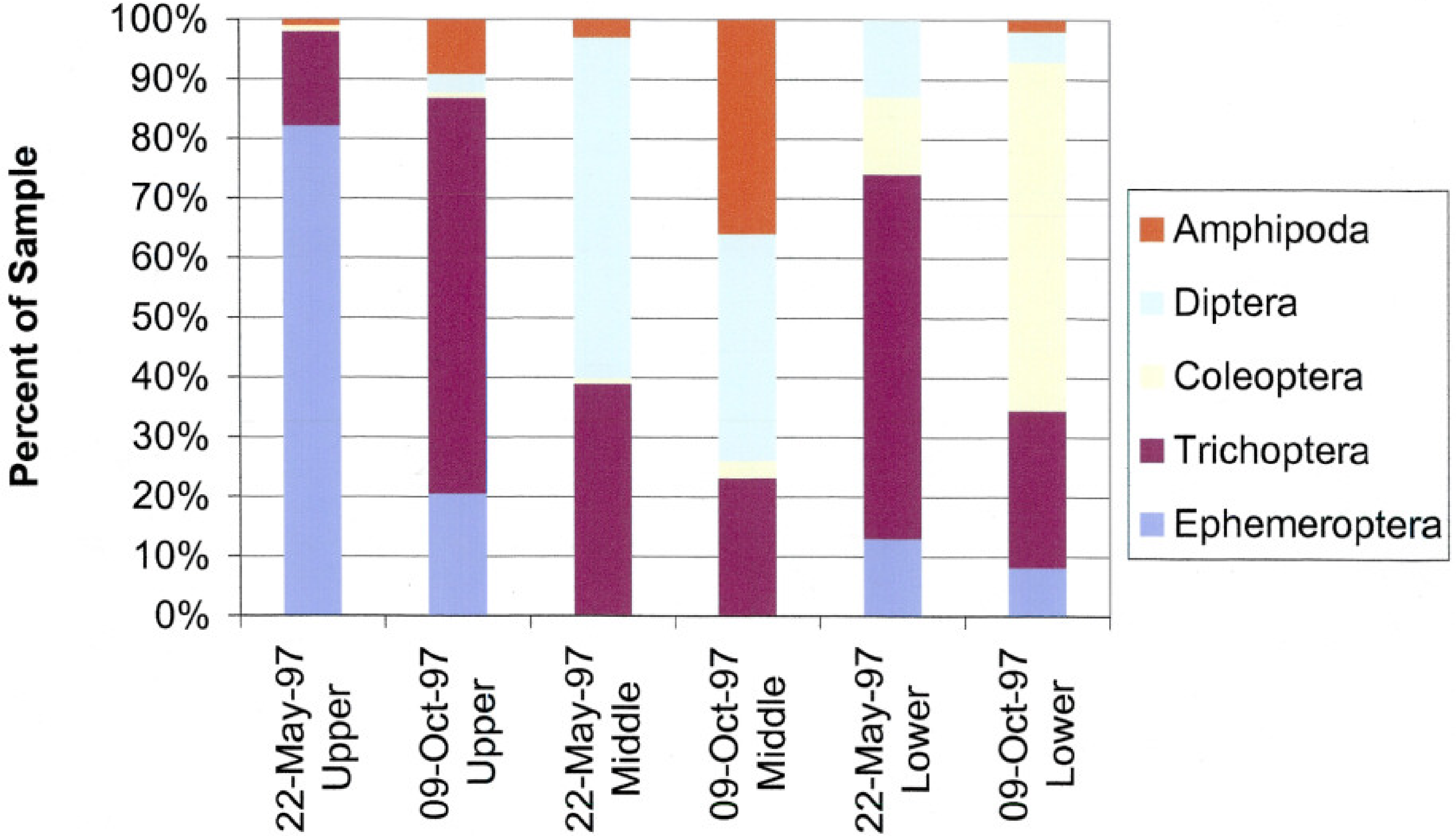


Figure 13.
Macroinvertebrate Sample Locations 1997

Figure 14. Seas Branch Aquatic Insect Families



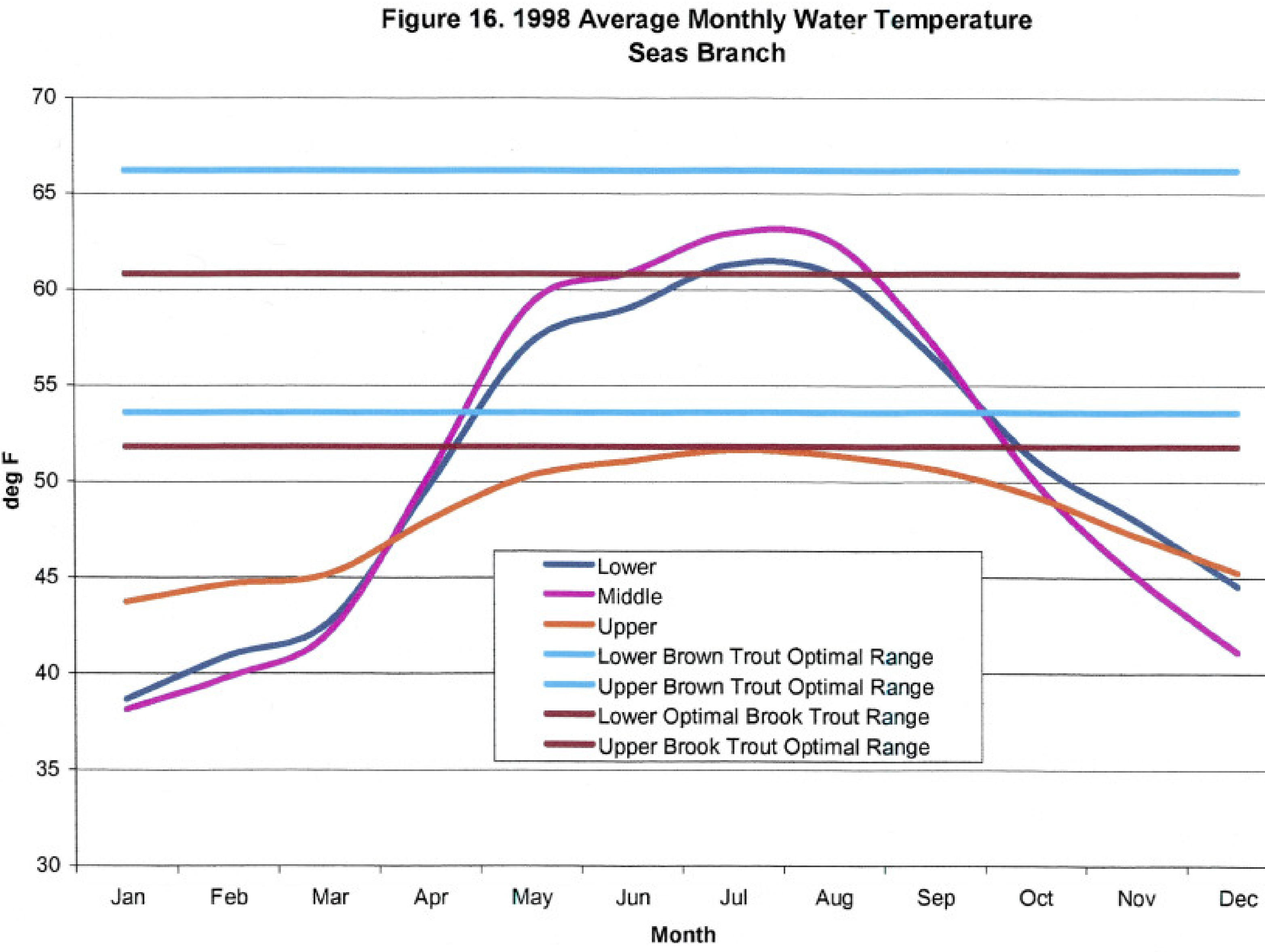


Figure 16. 1998 Average Monthly Water Temperature
Seas Branch
70
65
60
55
50
45
40
35
30
deg F
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Lower
Middle
Upper
Lower Brown Trout Optimal Range
Upper Brown Trout Optimal Range
Lower Optimal Brook Trout Range
Upper Brook Trout Optimal Range

Figure 17. 1999 Average Monthly Water Temperature
Seas Branch

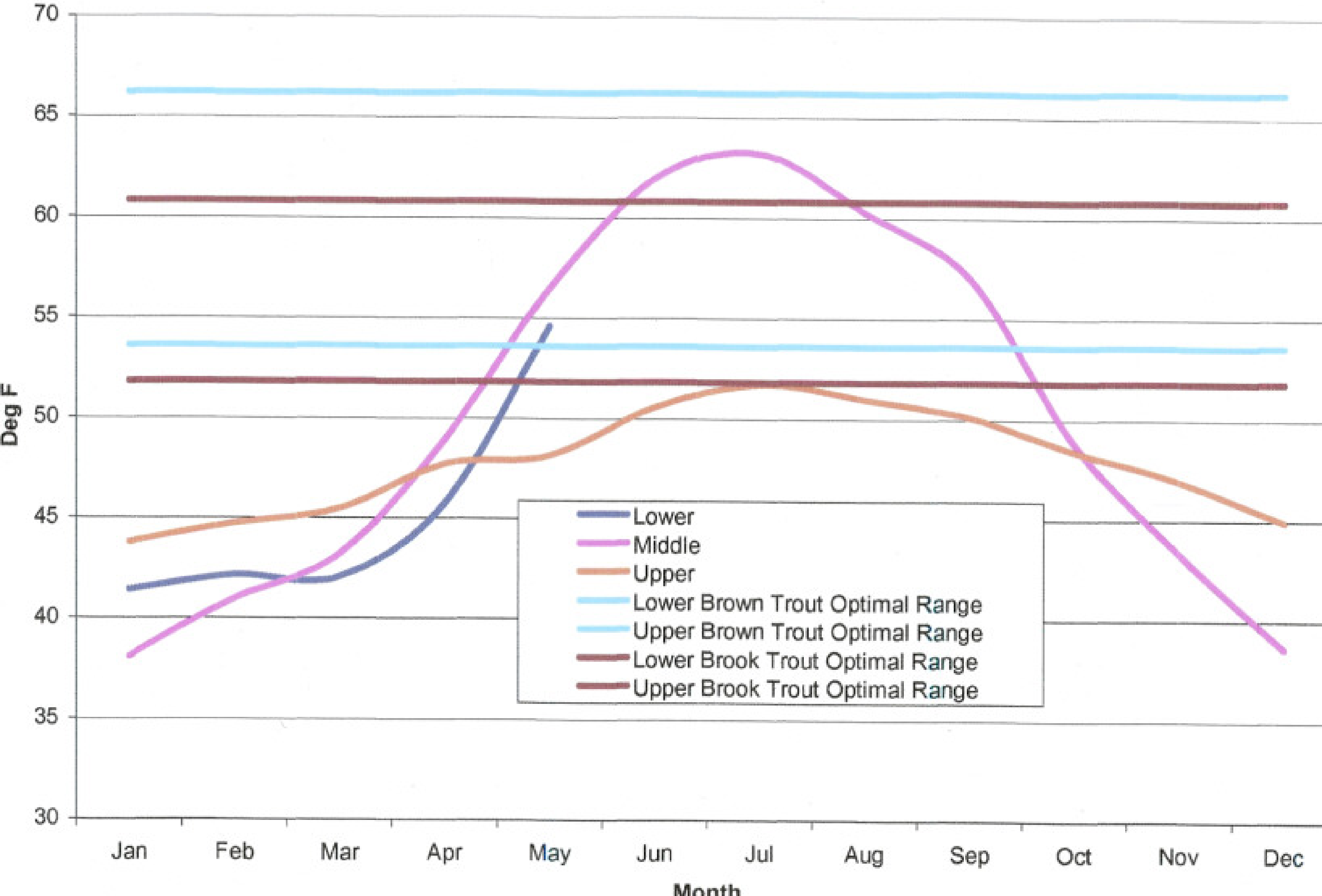
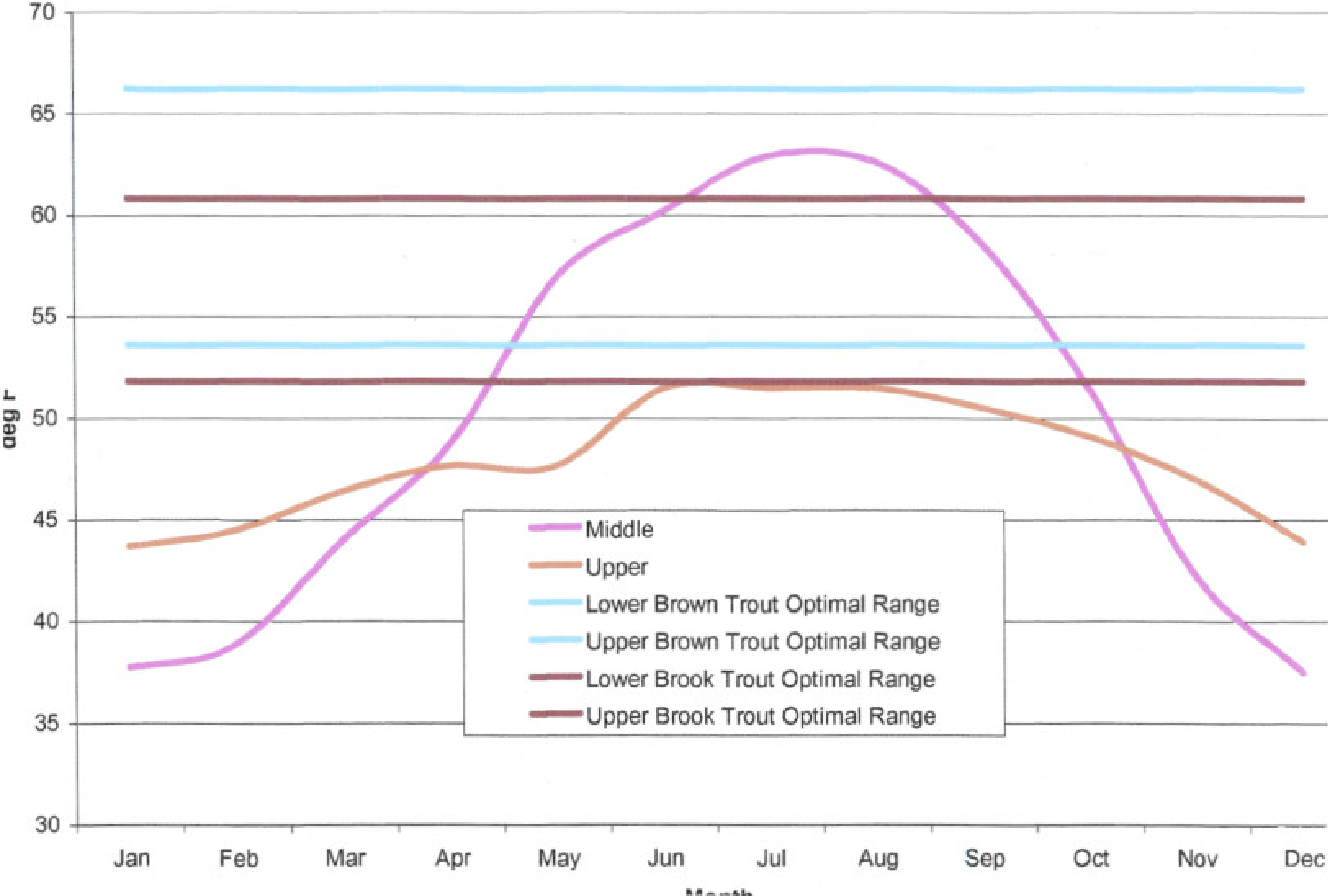


Figure 18. 2000 Average Monthly Water Temperature
Seas Branch



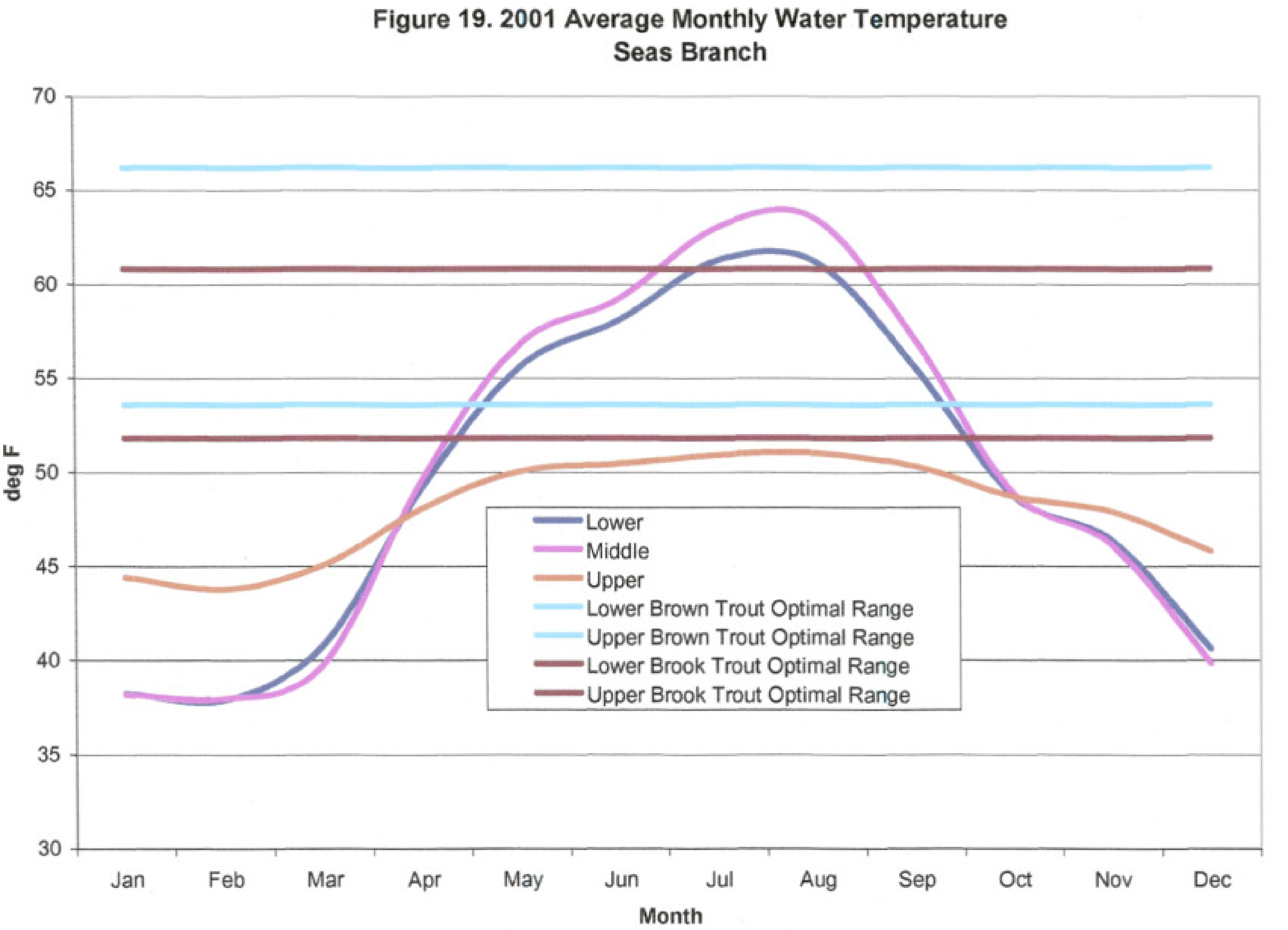


Figure 19. 2001 Average Monthly Water Temperature
Seas Branch
70
65
60
55
50
45
40
35
30
deg F
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Lower
Middle
Upper
Lower Brown Trout Optimal Range
Upper Brown Trout Optimal Range
Lower Brook Trout Optimal Range
Upper Brook Trout Optimal Range

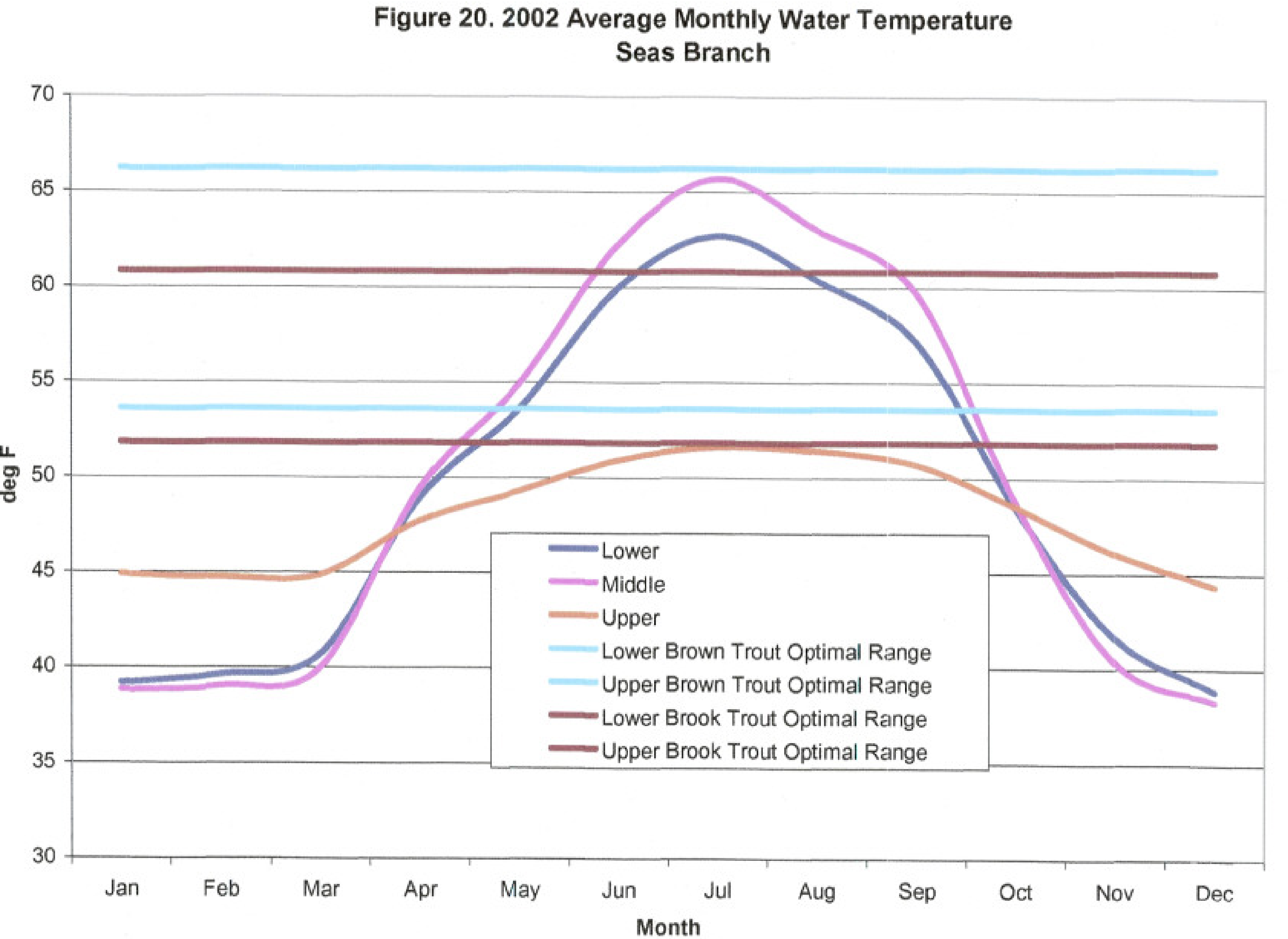


Figure 20. 2002 Average Monthly Water Temperature
Seas Branch
70
65
60
55
50
45
40
35
30
deg F
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
Lower
Middle
Upper
Lower Brown Trout Optimal Range
Upper Brown Trout Optimal Range
Lower Brook Trout Optimal Range
Upper Brook Trout Optimal Range

**Figure 21. 2003 Average Monthly Water Temperature
Seas Branch**

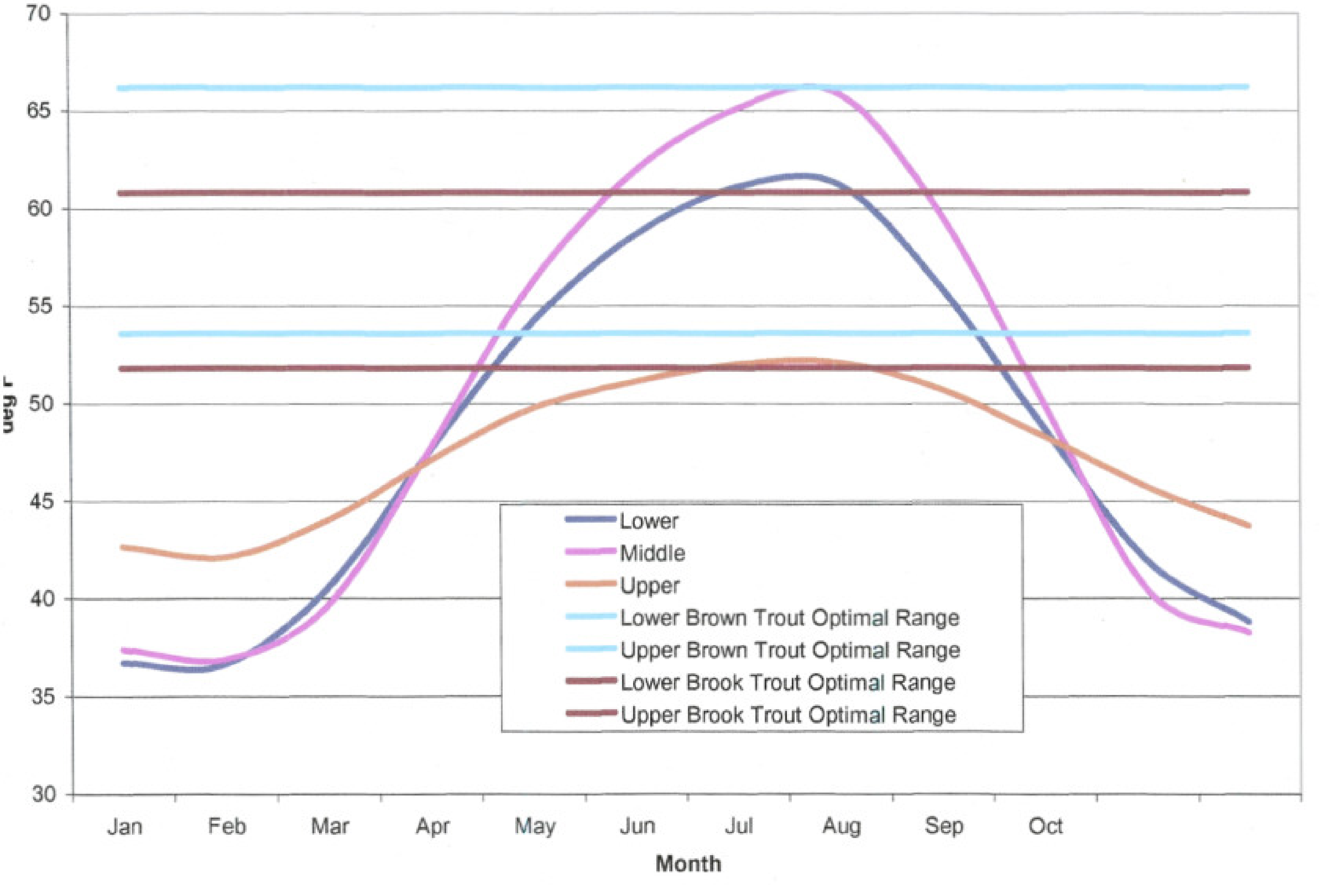


Figure 22. 2004 Average Monthly Water Temperature
Seas Branch

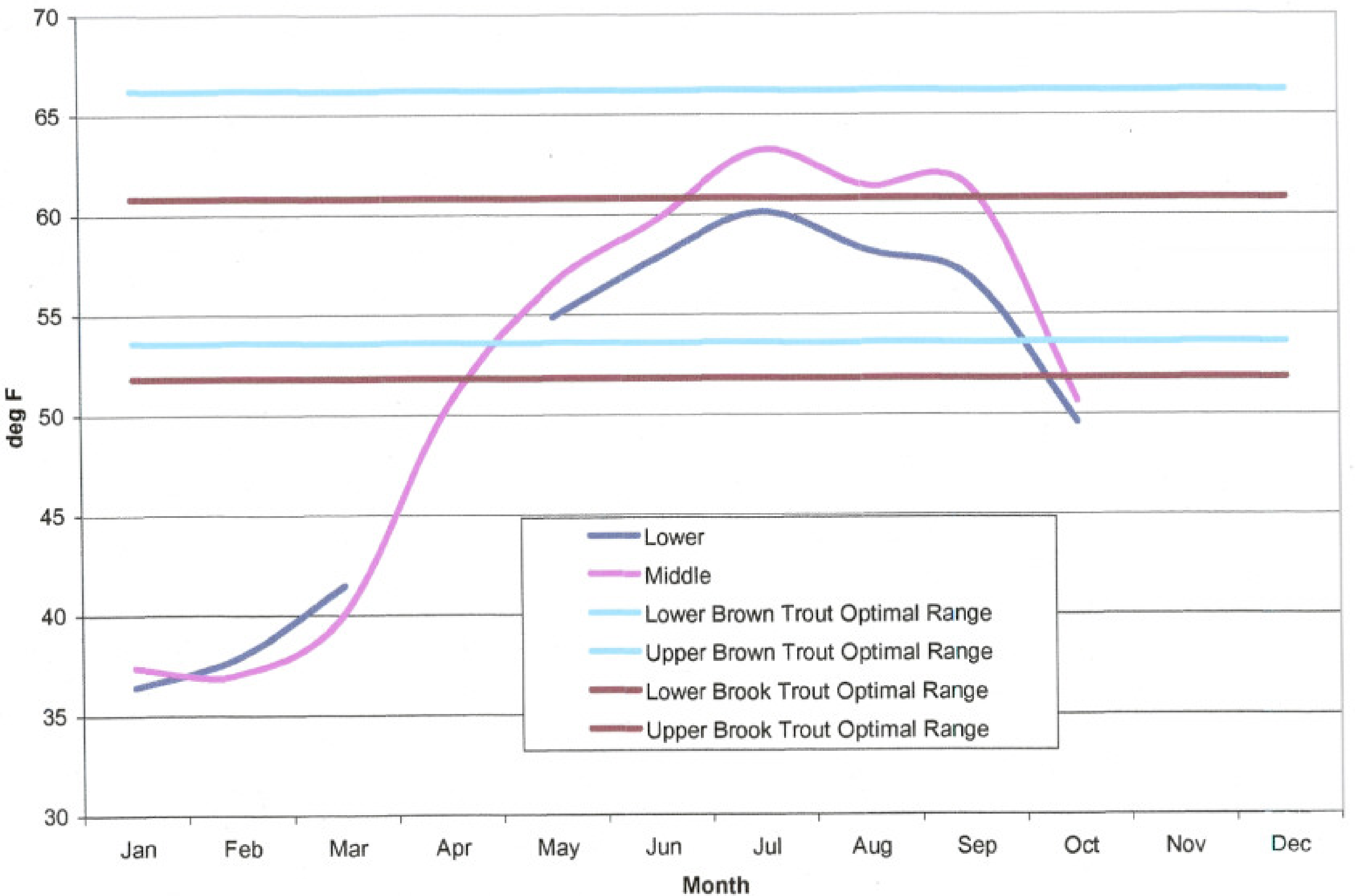


Figure 23. Seas Branch 1998 Summer Water Temperature Frequency Analysis Vernon County, WI

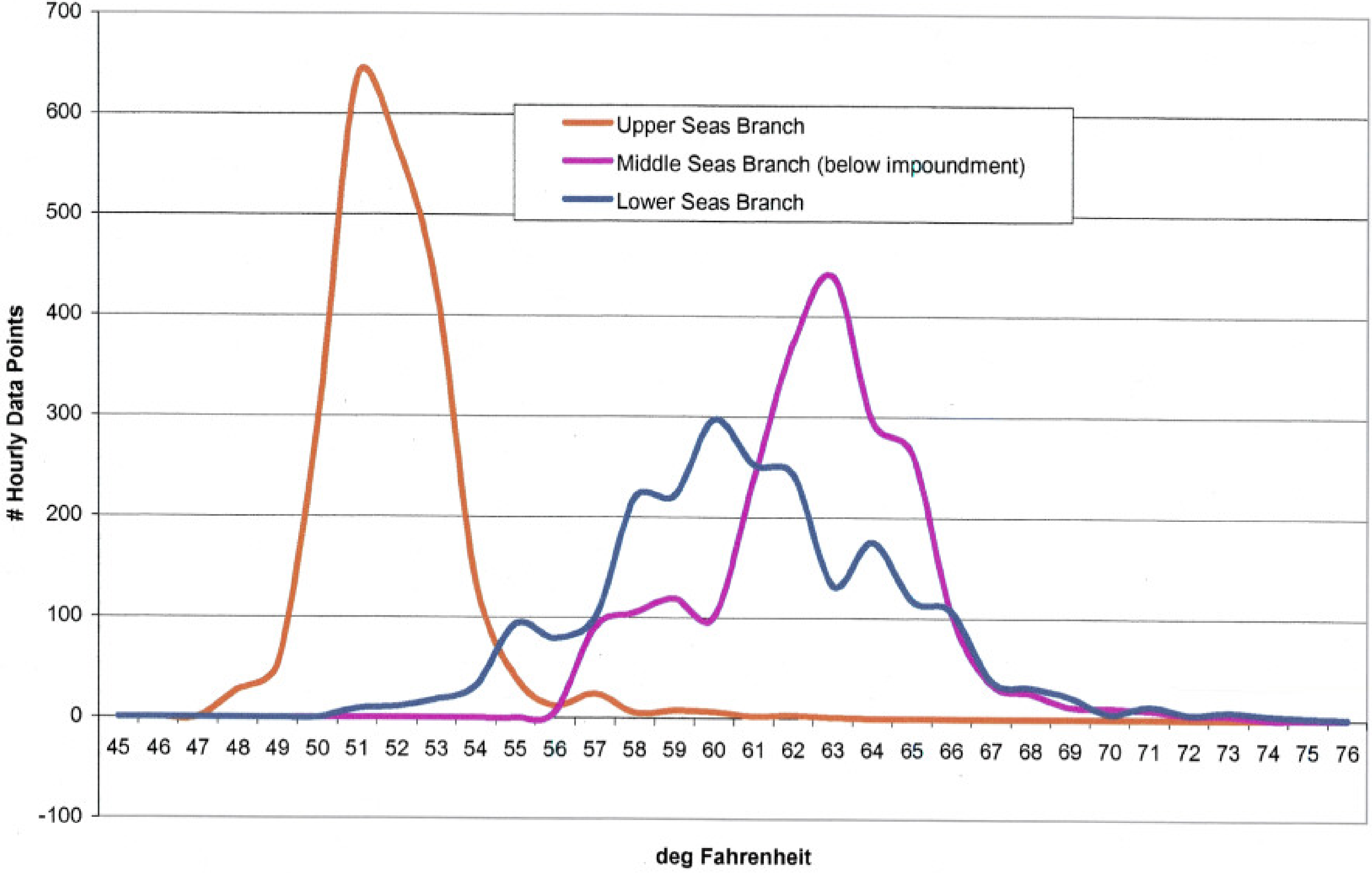
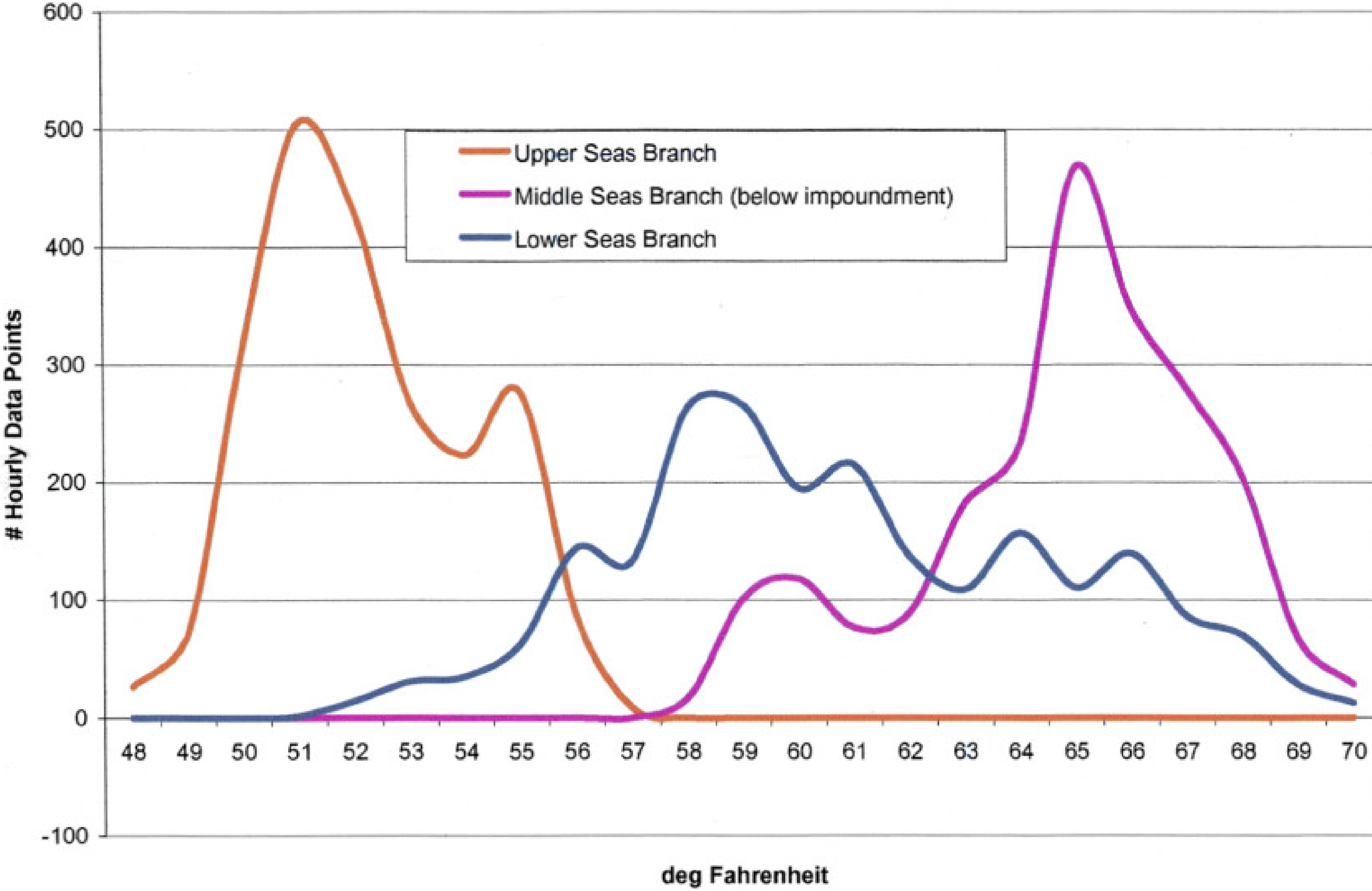


Figure 24. Seas Branch 2003 Summer Water Temperature Frequency Analysis
Vernon County, WI



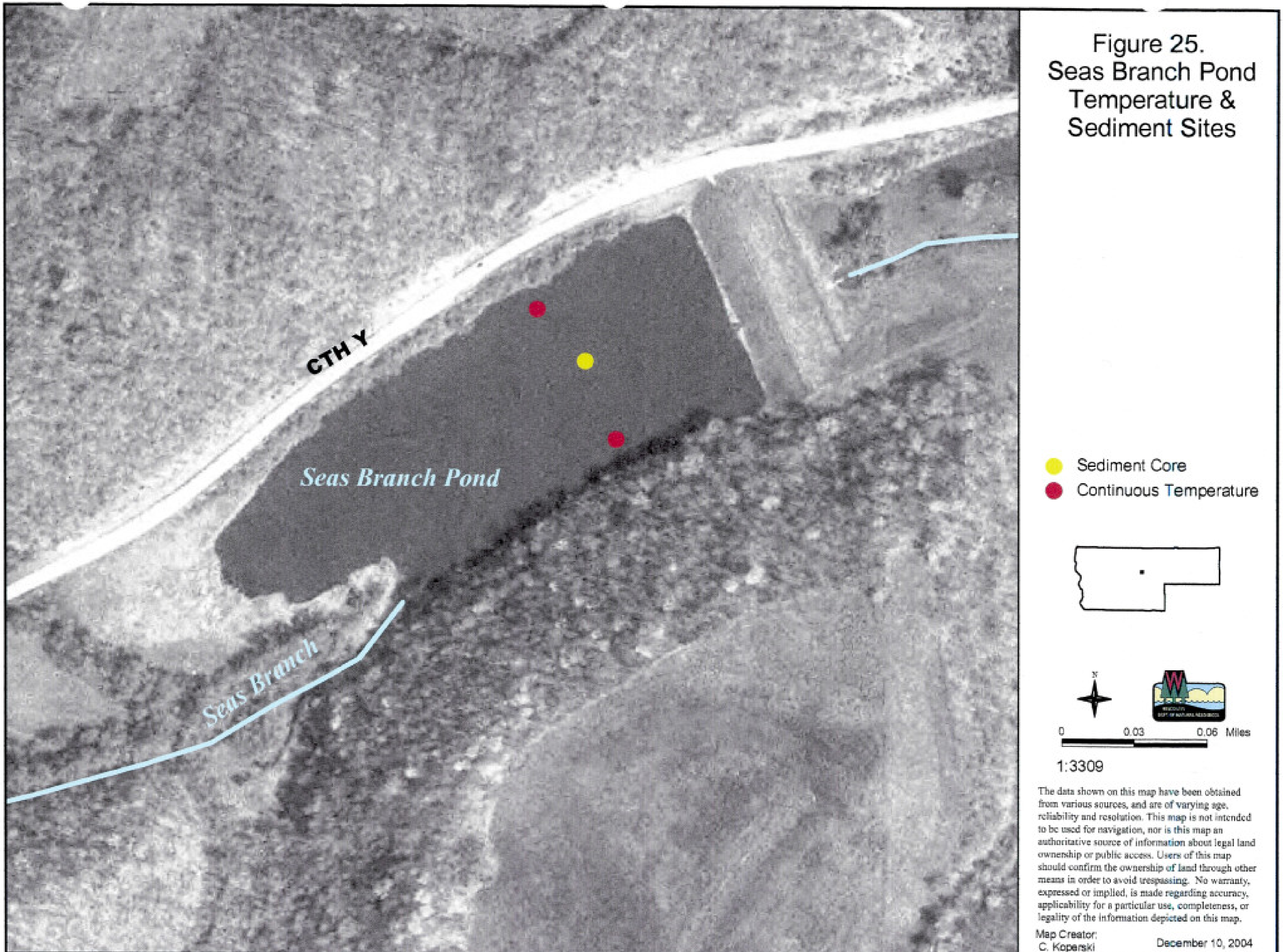


Figure 25.
Seas Branch Pond Temperature & Sediment Sites

Figure 26. SEAS BRANCH POND TEMPERATURE DATA
Sept 2002 through Sept 2003