

Epson 7800 B&W Setup “7800-EbHP”¹

MIS Eboni MK Hewlett Packard PK

www.PaulRoark.com

1-8-2010

The purpose of this effort is to optimize the Epson 7800 printer for black and white printing, with maximum print longevity and relatively neutral print tones primary objectives. This setup uses a combination of MIS Eboni-based 100% carbon inks for medium-warm printing on matte paper, and Hewlett Packard Z3100/3200 Vivera PK-based blended carbon-color inks for more neutral matte prints and neutral-cool glossy prints.²

Using 100% carbon pigments in an inkjet printer is the most lightfast, tonally stable printing approach we have for practical black and white photography today.³

MIS Associates' Eboni MK is the most neutral 100% carbon pigment available for inkjet printing, and was selected due to that characteristic as well as its very good dmax. The Eboni dilutions are warmer than the straight MK, but less warm than the other dilute 100% carbon inks. The Eboni-based inks are for matte paper only.

The Hewlett Packard Z3100/3200 Photo black (“HPPK”) appears to be the best neutral carbon-color blended ink we have available. It can print on many different types of paper with a neutral-cool image tone, and it appears from fade tests to be very stable, even if less stable than 100% carbon.⁴ Thus for more neutral matte printing than Eboni can achieve and for glossy printing, HPPK-based inks will be added to this 7800 setup.

¹ This is version 2. Version 1, Eboni only, is summarized at <http://www.paulroark.com/BW-Info/7800-Carbon-6.pdf>.

² For very warmer, 100% carbon matte paper printing, I recommend Jon Cone's K6 Carbon Sepia. For very warm 100% carbon glossy or matte printing various MIS B&W inksets can be used. See <http://www.paulroark.com/BW-Info/> for a list of MIS B&W inksets.

³ See <http://www.paulroark.com/BW-Info/R1800-Lightfastness.pdf> for information on carbon ink lightfastness.

⁴ See <http://www.paulroark.com/BW-Info/HP-Neutral-Aa1-80MLH.jpg>, which shows Aardenburg-Imaging test results after 80 MLux Hrs. of fade. The inks received a top rating. See also <http://www.paulroark.com/BW-Info/Carb-v-Blended-Neutral-20MLH.jpg>, which compares Eboni to the neutral blended inks. See <http://www.aardenburg-imaging.com/> for the source material. See also <http://www.wilhelm-research.com/hp/Z3200.html>.

For the dilute Eboni and HP positions I will use the open source C6c clear base suspension medium to dilute the concentrated commercial pigments.⁵ These inks are also, however, commercially available. MIS “Eboni-6” inks are the equivalent alternatives for the dilute Eboni inks discussed here. HP sells dilute neutral gray pigments that are roughly equivalent to the dilutions made with the open source base. Thus this approach is available to those who prefer to use only commercially available inks. Users must, however, load the inks into 7800 cartridges.⁶

Inks & Positions – Eboni & HPPK, with C6c Dilutions⁷

The ink dilutions and placements in the 7800 are listed below. While I will be using the C6c generic base,⁸ I have listed the pre-mixed commercial equivalents in parentheses.

Carbon/Eboni-6 medium warm matte inks:⁹

K = 100% Eboni

LK = 30% Eboni (Eb6-C, similar to MIS UT-C in density)

LLK = 9% Eb (Eb6-LC, similar to MIS UT-LC in density)

M = 18% Eb (Eb6-M, similar to LK in density)

LM = 6% Eboni (Eb6-LM, similar to LLK in density)

HP Z3100/3200 Vivera Neutral-Cool PK-based inks:¹⁰

C = HP Z3100/3200 Vivera Photo Black (“HPPK”)

LC = 30% HPPK (similar to HP Vivera gray [LK])

Y = 9% HPPK (similar to HP Vivera light gray [LLK])

⁵ See <http://www.paulroark.com/BW-Info/Ink-Mixing.pdf> for general information on the C6 base, and <http://www.paulroark.com/BW-Info/Eboni-6.pdf> for more on Eboni-6. Carbon-6 and Eboni-6 are essentially interchangeable, using the same profiles.

⁶ I currently use MIS (\$18 each, empty). See

http://www.inksupply.com/inkjet_cartridges.cfm?search_getmodel=460

⁷ Eboni-6 and HP PK have been installed and very successful in my 1400 for more than one year.

See <http://www.paulroark.com/BW-Info/Eb1400.pdf>

⁸ This 3rd version of my C6 generic base is incrementally smoother than the previous version, particularly on Arches uncoated paper, which is a specific target of this effort. The previous versions of the C6 base continue to be viable alternatives for those who do not have the stronger surfactants readily available. See <http://www.paulroark.com/BW-Info/Ink-Mixing.pdf> for more information on these open source dilution bases.

⁹ This Carbon/Eboni-6 inkset omits only the 2% dilution, which is not needed in modern printers. All Eboni inks can be purchased pre-mixed from MIS as bulk Eboni-6.

See <http://www.inksupply.com/eb6.cfm>

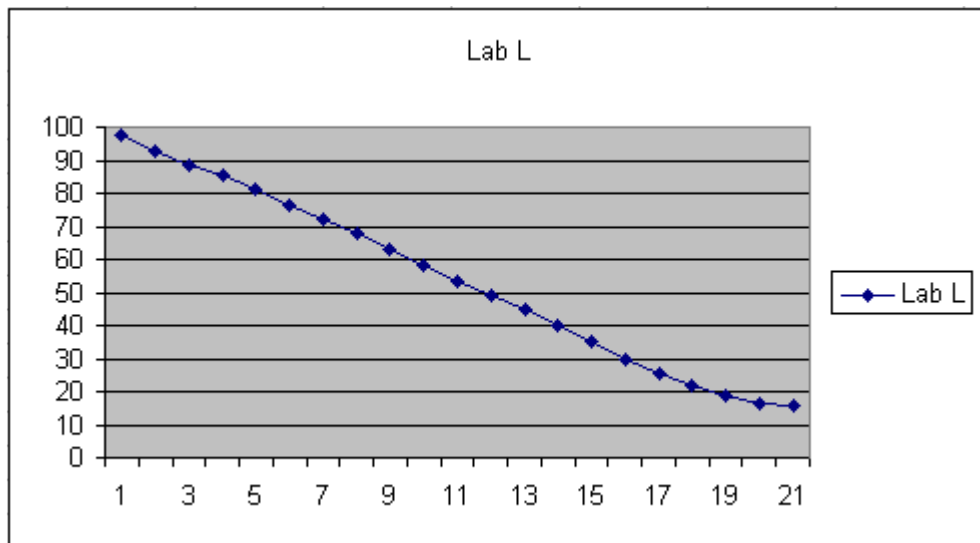
¹⁰ I purchase HP Photo Black at http://www.atlex.com/hp_designjet/z3100.htm

Note that dilute Eboni pigments must be agitated more often than most other pigments.¹¹

Epson Driver Workflow

This ink arrangement is compatible with the Epson driver. While I often if not usually use QuadToneRip¹² for my fine art printing, it is very handy to have the Epson driver option available.

I work in Gray Gamma 2.2 space, which is a subset of Adobe RGB (1998) and sRGB, the most common color spaces. With the print preview setting “No Color Management” selected¹³ and the printer driver set to UltraSmooth Fine Art paper type, Color Controls, Gamma 1.8, and the highest quality settings, matte papers should print with a ramp that is quite close to how the monitor displays the image. The Lab L distribution of a 21-step test file printed on Premier Art Generations Alise Museum (Natural) paper is shown in the graph below. Compare this to the ideal, color managed Gray Gamma 2.2 ramp in the next graph; they are very similar.



The print tone with no profile with Alise natural is medium warm, with a rise of about 2.5 Lab B units from the paper white to the maximum warmth at 50%. With a very cold

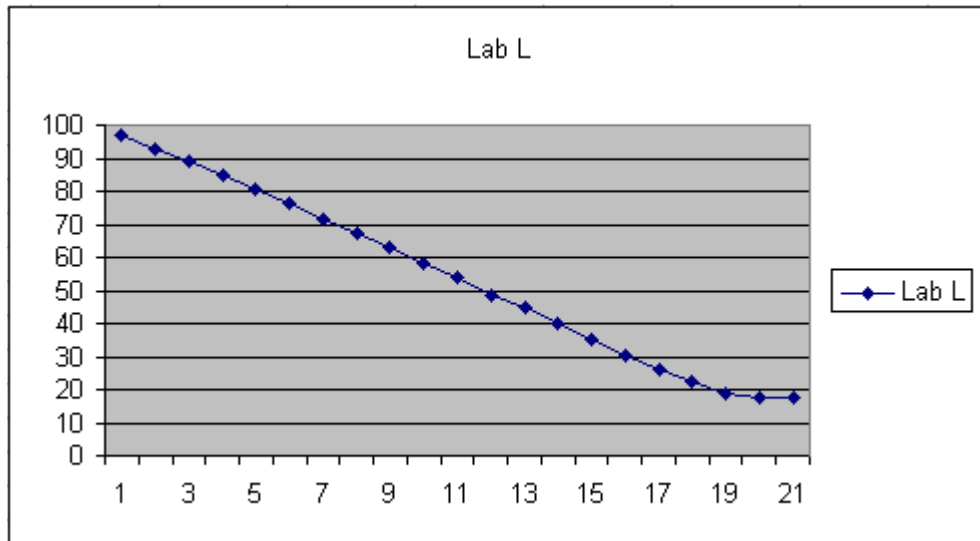
¹¹ The MIS or other standard carts are most easily agitated by removing and shaking them. How long the seals will last is unknown. A CIS system may be the easiest to agitate. See http://www.inksupply.com/cfs_7800_new.cfm Funnel fill carts are also available from MIS. See <http://www.inksupply.com/funnelfill.cfm>. Ink should be kept in the dark to avoid the possibility of algae, which has been reported to be a problem in some CISs in sunny climates. These clear carts might best be covered by a black plastic sheeting. Some “agitate” ink in them via syringe in the fill hole.

¹² See <http://www.quadtonerip.com/html/QTRoverview.htm>. “QTR” is shareware written by Roy Harrington.

¹³ With CS4 and a grayscale file have the print preview set to PS Manages Color with Print Profile = Working Space (Gray Gamma 2.2) or Printer Manages.

paper like Red River Polar Matte, the Lab B will go from the paper white of -4.5 to a maximum of Lab B = 2 at about 60%.

An ICC made with QTR's Create-ICC usually is all that is needed for a very good, "color managed" workflow.¹⁴ The graph below shows the results of an ICC with Gray Gamma 2.2 workspace. This also shows the idealized Gray Gamma 2.2 relative density distribution that is shown on a calibrated monitor. Note how close it is to the driver's standard Color Controls 1.8 print output, above.



Arches Hot Press will also print with the Epson driver, but not well. The dmax with the Epson driver is a bit low, and the Epson driver midtone ink limits are too high. So, for the best results on Arches Hot Press I recommend the QTR rip.

QuadToneRip

QTR is my preferred method of printing with this inkset. It gives the most control of the inks and print tones, and it usually results in a deeper black (better dmax). I'll be placing my QTR and other profiles in a Zip file for downloading.¹⁵

Note that I use Window XP, so the following is based on the Windows QTR interface and Windows workflow, which treats QTR as a stand-alone printer utility.

¹⁴ In this context a "color managed" workflow will result in print relative densities that match those seen on a calibrated monitor. Note that with the use of QTR's Create ICC-RGB one can embed a Photoshop curve in the ICC for tone control. This curve, if it separates the CMY channels also results in a high bit depth pipeline to the printer – rare in B&W workflows. Whether it makes any difference is debatable. The importance of high bit depth is in the manipulation of the file in Photoshop.

¹⁵ See <http://www.paulroark.com/BW-Info/7800-EbHP-Profile.zip>. I use the 7800-UC folder and Quad7800 printer model. The profiles need to be pulled into the Curve Creator and saved to make the required *.quad files.

In general, I use and profile in QTR in the usual manner. General QTR procedures will not be repeated here.

For tone control I find it very flexible to have an Ebony-only profile and also an HP, cool profile that uses the HPPK based inks for the midtones and Ebony for the black. QTR then allows these 2 profiles to be used together. Sliders allow control of how much of each channel is used, including control of split tones or leveling out the tones of no split tone is wanted. For example, with Premier Art Smooth 325 (no OBAs), by using 80% HP (cool) in the highlights, 50% in the midtones, and 20% in the shadows, the resulting print is very neutral. See the tone graph on page 7, below.

QTR Profiling for Arches Watercolor Paper

Arches' papers have an outstanding reputation, based on centuries of paper making, and they are reasonable priced and readily available in 22 x 30 sheets.¹⁶ I think it is the best watercolor paper, having the highest dmax of un-coated papers. Un-coated papers may have superior longevity and some other advantages due to not having a coating, but they also generally do not print as well or easily. Due to its potential and reputation, Arches is a paper that fine art prints should get to know and not dismiss based on the poor result one gets with the Epson driver. QTR or other rip is a must for this paper.¹⁷

Black Ink Limit & Boost

Ink limits can vary somewhat from paper batch to paper batch. As such, checking the Ebony ink limit for different paper batches may be advisable. In part to keep changes in the black ink limit from affecting the entire profile, I use the Black Boost. This puts a very steep slope on the very end of the black ink curve. The value put into the Black Boost box is that which gives the best dmax. When this Black Boost is changed, it does not affect the rest of the profile. In the Curve Creator K "ink limit" box I put the value where the additional density in adjacent patches is very small – that is, where the slope of the Lab L curve becomes very low. This point will be well below the dmax point used for the Black Boost and does not usually need to be changed from paper batch to paper batch.

For Arches HP I find the slope of the curve levels off substantially at about 70%. As such, that is where I've set the K ink limit, even though the dmax is usually not hit until 100.

¹⁶ Arches papers have been made and used by artists for close to 500 years. It is widely available at art stores in 22 x 30 sheets. I use "140 pound" (about 300 gsm) thickness "Hot Press" (smooth surface) "Bright White" (no OBAs and not much brighter than the standard Arches). A "cold press" with more of a texture prints the same as the hot press. There is also a "rough" surface available that I have not tried. I recommend <http://www.dickblick.com/categories/watercolorpapers/#artistwatercolorpapers> as a source.

¹⁷ Some of the material in this section is repeated at <http://www.paulroark.com/BW-Info/Arches.pdf>.

Arches Midtone Ink Limits

Because it is an un-coated paper, Arches is prone to bleed and look “blotchy” (rough) at fairly low ink loads. Thus for most of the inks, the ink limit will relate more to how smoothly the ink prints than whether it’s reaching its maximum density. However, the bleed is hidden in the deep shadows, so for the K position, the dmax is the primary issue.

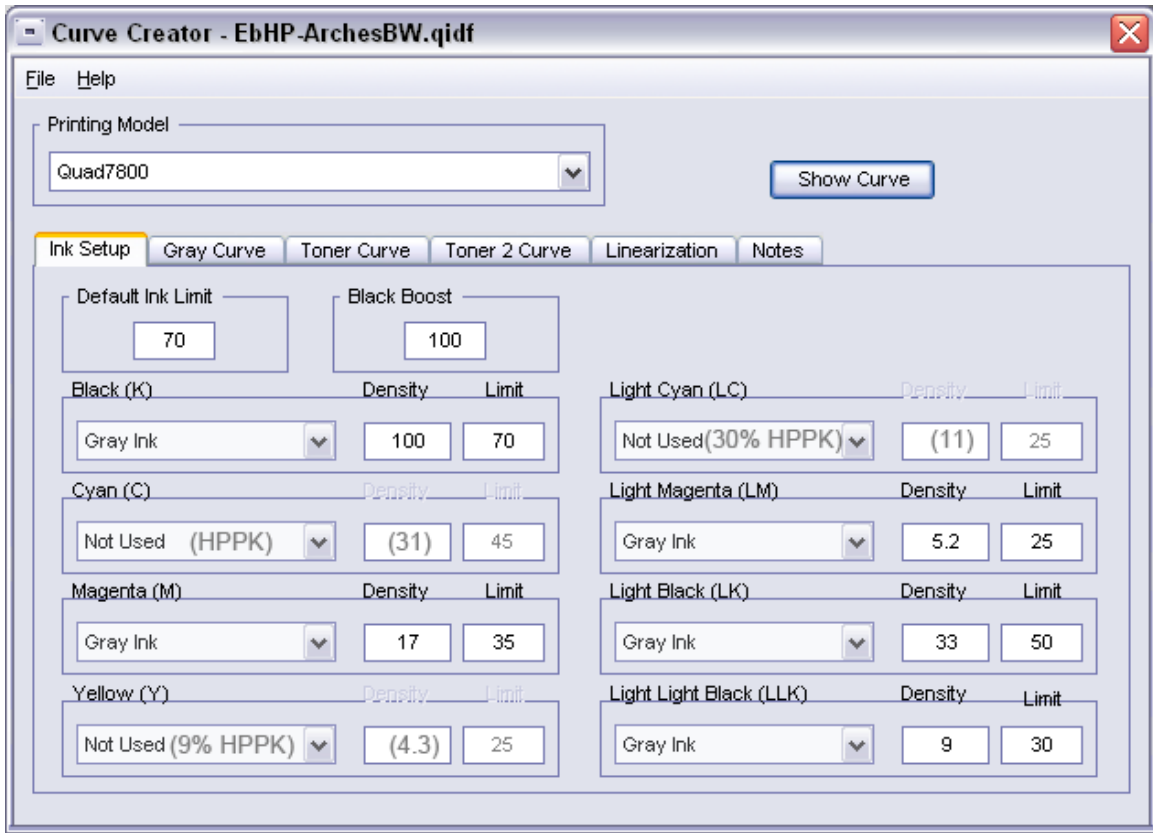
With coated papers the lighter inks can usually have a higher ink limit than the black ink. Thus Arches is the opposite in this respect from coated papers. That is a major reason why the Epson printer driver works poorly with this paper.

The ink limits and other settings are shown in the screen grab of the QTR Curve Creator, below. This profile was for Eboni carbon inks only. However, I have added the settings for the HPPK cool profile also. The dilute Eboni inks would be shut off and the HPPK inks (and Eboni MK) would be “gray” inks for the cool profile.

Arches Ink Densities

QTR ink densities are usually set by measuring the density of the midtones at their ink limits and comparing these densities to a black 21-step test print that was printed at its ink limit, here 70. In this respect, Arches profiling is no different than other papers. If, for example, the cyan position ink at the limit selected for it is equal to the black (limit 70) ink test patch at 35%, then the cyan ink would have a density value of 35 in the QTR Curve Creator. Usually some interpolation is needed to hit the exact density value.¹⁸

¹⁸ I am not certain how accurate these density figures need to be. I’ve found that often the “densities” of the identical inks used in, for example, the C and LK positions vary slightly. For simplicity I usually average them. On the other hand, having them be different might help with separating the starting points of some of some of the duplicated ink densities. I doubt more than 2 digit accuracy is ever needed here, and considerable slop appears to be tolerated by the QTR partitioning system.



Print Tones

For monotone inksets choosing different papers is the only way to alter print tones. With the addition of the HPPK neutral-cool pigments, profiles can vary the ratio between how much of the relatively warm Eboni and cool HPPK inks are used. So, there are lots of options with respect to tone on matte papers.

With most papers I make 2 profiles. For one profile I use only the 100% carbon Eboni-based inks. This usually makes a medium warm print. I make a second profile with the 3 neutral-cool HPPK-based inks and Eboni MK. This makes a cool profile. I finding for images that I want neutral, a 50-50 or other blend of the two profiles with the sliders in QTR is the easiest way to control the print tone.

The graph below shows the Lab B values for 21-step test strips on various papers.¹⁹ Lab B (warm yellow positive, blue cool negative) is the primary axis along which B&W print tones usually vary. Almost all paper manufacturers set a slightly positive Lab A (red/magenta positive, green negative) to avoid a greenish look. The Lab A values for

¹⁹ Lab B is the primary variable with respect to image tone. Lab A values are always positive and vary much less, following the trend of the Lab B values but with little actual change. As such, for simplicity, the Lab B values “show” the relative image tones of the various papers with good accuracy.

the inks generally follow the Lab B values in direction, but with much less variance from the paper base. So for simplicity in comparing paper tones, Lab B makes a good measure. With the inks I've used in this setup and all of the papers below, the print tones vary within a relatively narrow range of from neutral-cool to medium warm. People would react to all or them as being relatively neutral B&W images. These are subtle tone differences; the warmest at about Lab B=5 is not close to a true sepia that might have a Lab B=25.

Premier Art Smooth Bright White (PaSmBW) is my old standard paper for the most neutral-cool prints with dilute carbon inks. Since it has optical brightening agents (OBAs) in it, I'll be phasing it out for fine art uses in favor of papers with no OBAs.²⁰

Red River Aurora Natural has the lowest Lab B of the non-brightened paper's I've tried. That is, it is the "brightest" of the no-OBA, "natural" papers I know of. It may also be the least expensive cotton-based, fine art inkjet paper.²¹ With a ratio of 70% HPPK to 30% Eboni based pigments, the tones are very neutral without looking bluish. See the "AuroraN-7-3" curve in the Lab B graph below.²²

Premier Art Smooth 325 is a thicker and, of course, more expensive paper with a better dmax (1.70 v. 1.65), but not quite as bright a paper base. This is the paper that I think very highly of and specified for the local museum project.²³ See the "Pa325-8-5-2" graph line below. This print tone was made by having 80% HPPK in the highlights, 50% in the midtones, and 20% in the shadows, using the QTR sliders.

Hahnemuhle Photo Rag (HPR) is a popular paper that prints with a distinct split tone and a high dmax. Many coated inkjet papers print with this high degree of split tone if just Eboni carbon is used. It does use OBAs. HPR makes a very nice looking image, with a very high dmax.

Premier Art's Generations Alise Museum (or what I call "natural" – "GenAliseN") prints similarly to HPR, has no OBAs in it, and is about the only paper that can top HPR's dmax. With a profile that is 50% Eboni and 50% HPPK, AliseN prints with a modest Lab B increase of about 2 units and looks relatively neutral. This is a relatively new paper that shows promise.

Arches Hot Press "Bright White" has no OBAs in it, unlike "bright white" inkjet papers. Note that while its Lab B is relatively high, the delta-B is low. That is, from the paper white to the maximum Lab B is only about 2.3 units. Our perception of warmth is significantly affected by the change in Lab B values from the paper white to the maximum Lab B (delta-B). The eye will do a "white balance" on whatever references are

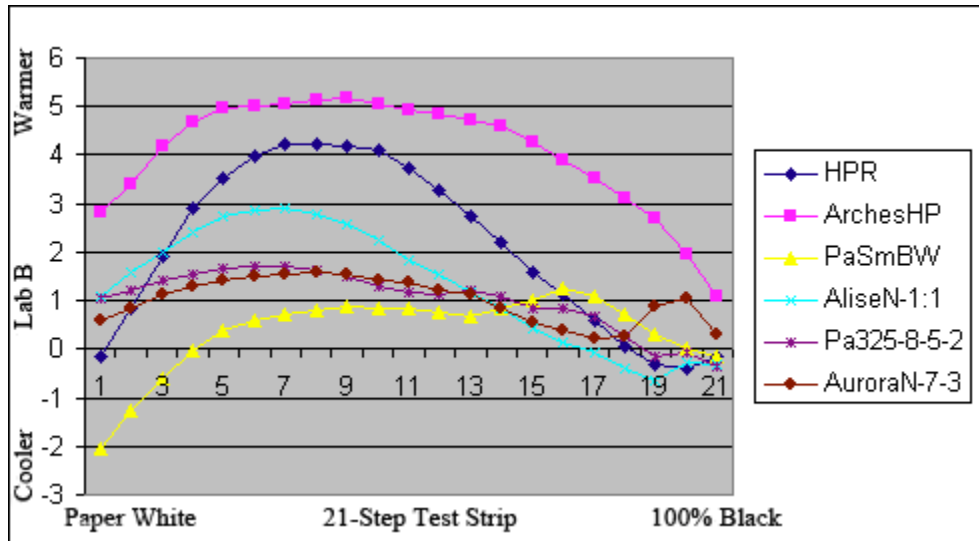
²⁰ OBAs are dyes that fade relatively quickly. While the HPPK pigments are a blend of color and carbon, they will be much more stable than OBAs. Thus this inkset and approach, among other things, is a switch from OBAs for cool prints to a very stable blended pigment ink for such prints.

²¹ For a 13 x 19" piece of paper, Red River Aurora Natural is about \$1.34; Arches \$170 (half of a 22x30 sheet); Premier Art Generations Alise Museum 16 mil \$2.26; and Premier Art Smooth 325 \$2.78.

²² See <http://www.redrivercatalog.com/browse/auroranatural.html> for Red River paper.

²³ See <http://www.premierimagingproducts.com/> for Premier Art papers.

around. If no bright white reference is close to the Arches print, it will look only slightly warm, based on the white balance of the paper and matte board and the relatively low increase in Lab B within the image. While this paper has a more modest dmax than the coated papers above and is harder to print smoothly, it may be the ultimate in fine art papers, and it's very reasonably priced and widely available at local art stores.



[This is a work in progress. More will be added as I get more experience with the approach.]

Paul

www.PaulRoark.com