
NARA Guidelines for Digitizing Archival Materials for Electronic Access



National Archives and Records Administration
8601 Adelphi Road, College Park, MD 20740, USA

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Researched, Written, and Compiled By: Steven Puglia, Preservation and Imaging Specialist,
and Barry Roginski, Computer Specialist

NOTE: The *NARA Guidelines for Digitizing Archival Materials for Electronic Access* presented here have been developed solely for internal NARA use in our pilot Electronic Access Project. We are posting the *Guidelines* on this site in response to requests. We welcome your comments and suggestions. In reviewing this document, please keep in mind the following:

- The *Guidelines* are not intended to be promulgated as a standard for digital imaging. The *Guidelines* cover only the process of digitizing archival materials for on-line access through the Electronic Access Project. Other issues that must be considered in conducting digital imaging projects, including preservation, are not addressed here.
 - The *Guidelines* do not constitute, in any way, guidance to Federal agencies on records creation or transfer to the National Archives of the United States.
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Digital Imaging Requirements

The goal of the National Archives and Records Administration's Electronic Access Project (EAP) is to produce an on-line catalog that will provide information about NARA holdings and a core collection of digital copies of selected high-interest documents.

These digitizing specifications have been developed to provide a method of evaluating the quality of images produced, to estimate the data storage for access files (on-line) and master files (off-line), and to assist in determining upgrades to the NARA network infrastructure. Inherent differences in document types dictate different approaches to scanning. Due to inconsistent legibility throughout NARA's holdings, due to the desire to image documents in a consistent manner, and due to the limited number of records to be digitized (approximately 120,000 to 200,000 in the initial phase), all scanning will be 8-bit grayscale or 24-bit color.

The tone reproduction approach for digitizing images has been geared toward providing good monitor representation, based on an "average" computer monitor determined by the visual evaluation of a selection and variety of monitors. The tone reproduction is to be done consistently for all images to facilitate the batch processing of derivative files or future adjustments to the distribution of the tones.

Specifications have been developed for the following types of materials-

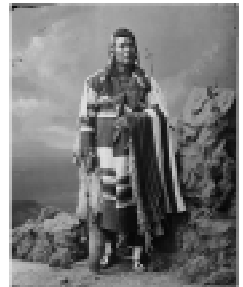
Textual Documents

Media formats to be provided for scanning include, original records, photocopies, photographic copy negatives or copy transparencies, or microfilm. The scanning resolution for the master files of 300 dpi for smaller documents was selected to be compatible with OCR software. The lower scanning resolution of 200 dpi for larger documents was selected to be of reproduction quality and to save file storage space.



Photographs

Media formats to be provided for scanning include B&W and color photographic prints, negatives, or transparencies. The digital image size for the master files of 3,000 pixels across the long dimension was selected to be of reproduction quality. A magazine quality halftone reproduction at 11"x14" in size and 133 lpi is achievable from this file size.



Maps, Plans, and Oversized Records

Media formats to be provided for scanning includes original records, photocopies, photographic copy negatives or copy transparencies, or microfilm. The scanning resolution for the master files of 300 dpi for smaller documents was selected to be compatible with OCR software. The lower scanning resolution of 200 dpi for larger documents was selected to be of reproduction quality and to save file storage space.



Graphic Records

Line drawings, artistic illustrations, and other similar records. Media formats to be provided for scanning include original records, photocopies, photographic copy negatives or copy transparencies, or microfilm. Smaller graphic records are scanned in the same manner as photographs and larger graphic records are scanned in the same manner as maps, plans, and oversized records.



Comments on Derivative Files

The resolution or size and the file formats for the access files and thumbnail files have been selected to facilitate speed of transfer via the Internet and to minimize the requirement for high speed CPUs and large amounts of memory on the end users computer. Optional large access file requirements are proposed here and may be added to NARA's EAP at some point in the future as Internet bandwidth increases. All derivative files are intended to be produced in an automated batch processing mode.

MASTER IMAGE FILES

Pixel Depth:

8 bit grayscale or 24 bit color, RGB mode.

Resolution and Image Size- Textual Documents and Maps/Plans/Oversized Records:

300 dpi effective resolution for original documents SMALLER than or EQUAL to 11"x17" or 187 sq. inches in size and 200 dpi effective resolution for original documents LARGER than 11"x17" or 187 sq. inches. Image size shall be the size of the original document at the scan resolution; examples: 8"x12" at 300 dpi or 16.5"x20.5" at 200 dpi.

Scanner or digital camera shall provide true optical resolution of at least 300 dpi effective resolution for the original documents; interpolating to a higher resolution from a lower resolution scan shall not be permitted.

Resolution and Image Size- Photographs:

Adjust scanning resolution to produce files with pixel arrays of 3000 pixels across the long image dimension by the proportional number of pixels for the specific photo format; example: 3000 pixels by 2400 pixels for 8"x10" or 4"x5" prints or negatives, 3000 pixels by 2000 pixels for 35mm slides or negatives or 4"x6" prints. For square images, adjust resolution to produce files with pixel arrays of 2700 pixels by 2700 pixels.

Final image size shall be set to a standard 10" across the long dimension at 300 dpi; examples: 8"x10" at 300 dpi for a 4"x5" negative or 6.7"x10" at 300 dpi for a 35mm slide. Square images shall be set to a standard 9"x9" at 300 dpi.

Scanner or digital camera shall provide true optical resolution of at least 3000 pixels across the long dimension of the image; interpolating to a higher resolution from a lower resolution scan shall not be permitted.

Resolution and Image Size- Graphic Records:

Adjust scanning resolution to produce files with pixel arrays of 3000 pixels across the long image dimension by the proportional number of pixels for original documents SMALLER than or EQUAL to 11"x17" or 187 sq. inches in size. Final image size shall be set to a standard 10" across the long dimension at 300 dpi and square images shall be set to a standard 9"x9" at 300 dpi.

200 dpi effective resolution for original documents LARGER than 11"x17" or 187 sq. inches. Image size shall be the size of the original document at the scan resolution; example: 16.5"x20.5" at 200 dpi.

Scanner or digital camera shall provide true optical resolution of at least 3000 lines or 300 dpi effective resolution for the original documents; interpolating to a higher resolution from a lower resolution scan shall not be permitted.

File Format:

Uncompressed TIFF files with Intel byte order and header version 6.

Scanning Aimpoint Values:

- Using a Kodak Gray Scale (Q-13 or Q-14) or equivalent photographic reflection gray scale- The gray scale is preferred because it is photographic and is more consistent from one copy of the gray scale to another.

Patch "A" or visual density of 0 to 0.10 to be rendered at RGB levels of 247 - 247 - 247 or at a % black of 3%.

Patch "M" or visual density of 0.70 to 0.80 to be rendered at RGB levels of 105 - 105 - 105 or at a % black of 59%.

Patch "19" or visual density of 1.90 to 2.00 to be rendered at RGB levels of 8 - 8 - 8 or at a % black of 97%.

- Using Kodak Color Control Patches (Q-13 or Q-14)- It is less desirable to use the color patches because they are printed on a printing press, they tend to be less accurate in color and density and to be less consistent from one copy of the color patches to another. The RGB values cited below are the average values for the Kodak color bars measured from actual scans that were adjusted for the Kodak gray scale.

White patch to be rendered at RGB levels of 241 - 241 - 241 or at a % black of 5%.

Gray background to be rendered at RGB levels of 101 - 101 - 101 or at a % black of 60%.

Single color black to be rendered at RGB levels of 19 - 19 - 19 or at a % black of 93%.

- Minimum and maximum RGB or % black levels when scanning materials with no reference gray scale or color patches, such as original photographic negatives:

For RGB scanning the highlight not to go above RGB levels of 247 - 247 - 247 and shadow not to go below RGB levels of 8 - 8 - 8.

For grayscale scanning the highlight not to go below % black of 3 % and shadow not to go above % black of 97%.

Scanning Aimpoint Variability:

- For RGB scanning- No more than a ± 3 RGB level variance from each aimpoint and no more than a 3 RGB level difference in the individual channels within each specified patch on the Kodak Gray Scale or Color Patches.
- For grayscale scanning- No more than a $\pm 1\%$ variation in % black from each aimpoint for the specified patches on the Kodak Gray Scale.

Maximum Tonal Range:

Generally, the RGB levels for a color image should range from 8 to 247 for a total of 240 levels or shades per channel and the % black for a grey scale image should range between 3% to 97%. The dynamic head-room at both ends of the scale is to ensure no loss of detail or clipping in scanning and to accommodate the slight expansion of the tonal range due to unsharp mask filtering. However, to accurately represent some digital images of certain documents, such as faded ink on darkened paper for a textual document or a low contrast photographic print, the tonal range may be significantly less than the maximum range cited above.

Tone Reproduction Control:

Use scanner controls to place white-point (patch "A" on Kodak gray scale or high-light detail on an original photographic negative) and black-point (patch "19" on Kodak gray scale or shadow detail on an original photographic negative) at desired RGB levels or % black. Use scanner gamma control to place "M" step value or to adjust tonal distribution for good monitor representation of the image. After scanning use Adobe Photoshop "levels" control for minor correction only; use the place black-point, place white-point, place mid-point and slider controls in that order.

Scanner Calibration:

For **original documents, photocopies, and photographic prints (B&W and color)**, calibrate the scanner to a Kodak gray scale. Sometimes when scanning photographic prints the low and high densities of the print are lighter and /or darker than those on the gray scale; check the RGB levels or % black of the image area on a preview scan and, if the print densities are lighter and /or darker, place the those densities at the appropriate aimpoint values cited above rather than using the gray scale.

For **copy negatives (B&W and color)**, if the copy negative has a Kodak gray scale in the image, adjust the scanner settings using the image of the gray scale to meet the above requirements. If there is no gray scale, the scanner software shall be used to match the tonal scale of the digital image to the density range of the specific negative being scanned and to provide an image adjusted for monitor representation.

For **color copy transparencies and color microfilm**, if the copy transparency has a Kodak gray scale in the image, adjust the scanner settings using the image of the gray scale to meet the above requirements. If there is no gray scale, the scanner software shall be used to match the tonal scale and color balance of the digital image to the specific transparency being scanned to provide an accurate monitor representation of the image on the transparency.

For **original color transparencies**, the scanner software shall be used to match the tonal scale and color balance of the digital image to the specific transparency being scanned to provide accurate monitor representation of the image on the transparency.

For **B&W microfilm**, scanner software shall be used to match the tonal scale of the digital image to the density range of the specific negative or positive microfilm being scanned; example: the minimum density of negative microfilm placed at a % black value of 97% and the high density placed at a % black value of 3% (% black values as indicated in Adobe Photoshop).

For **original photographic negatives (B&W and color)**, scanner software shall be used to match the tonal scale of the digital image to the density range of the negative being scanned and to adjust color balance for color negatives. Use place white-point, place black-point, and scanner gamma control or use histogram control to adjust or control tones in a manner similar to making a photographic print in the darkroom.

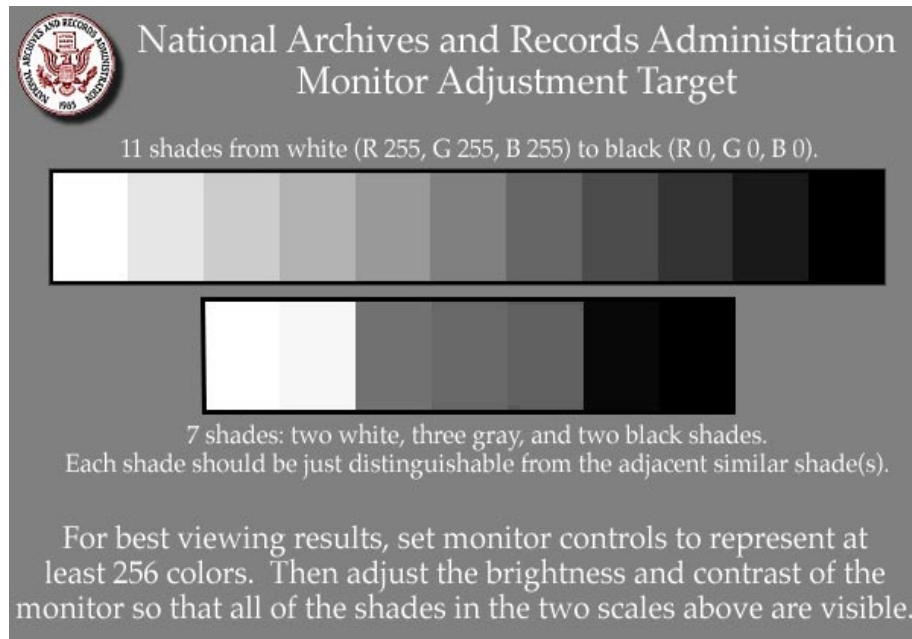
Monitor Calibration:

The monitors of the scanning and quality control workstations shall be set to 24 bits (millions of colors), a gamma of 2.2, and a color temperature of 6500°K. Consider calibrating monitor to proposed sRGB color space.

The monitors of the scanning and quality control workstations shall be adjusted, using visual evaluation, to the NARA Monitor Adjustment Target. Second, the monitors shall be calibrated using a photosensor-based color calibrator to ensure neutral color balance and linearity of the red, green, and blue representation on the monitor. Finally, a Kodak grayscale shall be scanned, the aimpoint values matched, and then final contrast and brightness adjustments shall be made on the monitors while visually comparing the scan and the Kodak gray scale.

National Archives Monitor Adjustment Target:

NARA shall provide a monitor adjustment target as a digital image file for use with all types of computer monitors. The NARA target shall be used to adjust all scanning and viewing workstation monitors.



This target has been designed to allow computer users to adjust the contrast and brightness of their computer monitor so that graphic images, such as scans of photographs, textual documents, or maps look their best. The digital images for NARA's Electronic Access Project have been scanned to provide a reasonably accurate rendition of the documents when viewed on an "average" computer monitor that has been adjusted to the target. The generic or "average" monitor representation was determined by visual evaluation of a large selection and variety of monitors, including both Windows computers set to a default gamma of 2.2 and Macintosh computers set to gammas of both 1.8 and 2.2.

Tonal Scale and Color Balance Adjustments:

All tonal scale and color balance adjustments should be controlled with the scanner software, minimal tonal scale and color balance adjustments shall be done to the image after scanning.

Sharpening:

Image files shall be sharpened as needed to achieve the approximate appearance of the original. All sharpening shall be done with an unsharp mask algorithm. Level of filtering will vary depending on the scanner and the material being scanned.

Typical unsharp mask parameters-	Amount	100% to 200%
	Radius	1 to 2 pixels
	Threshold	2 to 8 levels

For master file images, the amount of sharpening is usually at the higher end and the radius is usually at the lower end of the ranges cited above. Usually threshold can be set and used at a single value, such as 4 levels.

TIFF Header Information:

Common usage for specific header tags shall be followed, “typical” or “expected” data shall be provided for most tags and exceptions are noted in the following list. The following list conforms to Library of Congress TIFF header tag requirements-

Description	Tag	Comments/Required Data
NewSubfileType	254	
ImageWidth	256	actual pixel count
ImageLength	257	actual pixel count
BitsPerSample	258	
Compression	259	
PhotometricInterpretation	262	
DocumentName	269	NARA assigned doc. name
ImageDescription	270	orientation- portrait, landscape, or square
StripOffsets	273	
SamplesPerPixel	277	
RowsPerStrip	278	
StripByteCounts	279	
XResolution	282	actual pixel count
YResolution	283	actual pixel count
ResolutionUnit	296	
DateTime	306	date and time scanned
Artist	315	NARA

In order for the digital images to open in all software packages, the TIFF header tags shall be sorted in ascending numerical order.

OPTIONAL: LARGE ACCESS FILES (Not being produced for NARA’s EAP at this time.)

Textual Documents- For documents LARGER than 8.5”x14” or 119 sq. inches in size regardless of character height and for documents SMALLER than or EQUAL to 8.5”x14” or 119 sq. inches with character height of SMALLER than or EQUAL to 1.5mm.

Pixel Depth and File Format:

8 bit grayscale JPEG for grayscale images and 24 bit color JPEG, RGB mode, for color images for documents LARGER than 8.5”x14” or 119 sq. inches in size regardless of character height* and for documents SMALLER than or EQUAL to 8.5”x14” or 119 sq. inches with character height* of SMALLER than or EQUAL to 1.5mm. JPEG compression shall be set at medium or low quality or approximately 10:1 to 20:1 compression. The image size shall be the size of the original document at a resolution as specified below; example: 8”x12” at 125 dpi.

*Height of lower case character (usually lower case “e”) of the smallest type size on the document.

Image Size:

Images shall be resized from 300 dpi or 200 dpi master files to a smaller image size using the following settings-

90 dpi for 2.0 mm or larger character height.*

125 dpi for 1.5 mm character height.*

200 dpi for 1.0 mm or smaller character height.*

*Height of lower case character (usually lower case “e”) of the smallest type size on the document.

Photographs-

Pixel Depth and File Format:

8 bit grayscale JPEG for grayscale images and 24 bit color JPEG, RGB mode, for color images. JPEG compression shall be set at medium to low quality or approximately 10:1 to 20:1 compression.

Image Size:

3000 pixel dimension of master files shall be reduced to 1500 pixels across the long image dimension by the proportional number of pixels for the specific photo format; example: 1500 pixels by 1200 pixels for 8”x10” or 4”x5” prints or negatives, 1500 pixels by 1000 pixels for 35mm slides or negatives or 4”x6” prints. For square images, files shall be reduced to 1340 pixels by 1340 pixels.

Final image resolution for large access files shall be a default resolution of 150 dpi and the image size shall be 10” across the long dimension for rectangular images and 9”x9” for square images.

Maps, Plans, and Oversized Records-

Pixel Depth and File Format:

4 bit interlaced / 89a GIF files for 8 bit grayscale images and 8 bit interlaced / 89a GIF files for 24 bit color images for documents SMALLER than or EQUAL to 8.5”x14” or 119 sq. inches with character height* of LARGER than 1.5mm. The image size shall be the size of the original document at a resolution as specified below; example: 8”x12” at 125 dpi.

8 bit grayscale JPEG for grayscale images and 24 bit color JPEG, RGB mode, for color images for documents LARGER than 8.5"x14" or 119 sq. inches in size regardless of character height* and for documents SMALLER than or EQUAL to 8.5"x14" or 119 sq. inches with character height* of SMALLER than or EQUAL to 1.5mm. JPEG compression shall be set at low quality or approximately 20:1 or higher compression. The image size shall be the size of the original document at a resolution as specified below; example: 20"x24" at 90 dpi.

*Height of lower case character (usually lower case "e") of the smallest type size on the document.

Image Size:

Images shall be resized from 300 dpi to a smaller image size using the following settings-

90 dpi for 2.0 mm or larger character height.*

125 dpi for 1.5 mm character height.*

200 dpi for 1.0 mm or smaller character height.*

*Height of lower case character (usually lower case "e") of the smallest type size on the document.

Graphic Records-

Pixel Depth and File Format:

8 bit grayscale JPEG for grayscale images and 24 bit color JPEG, RGB mode, for color images. JPEG compression shall be set at medium to low quality or approximately 10:1 to 20:1 compression.

Image Size:

For documents SMALLER than or EQUAL to 11"x17" or 187 sq. inches, the 3000 pixel dimension of master files shall be reduced to 1500 pixels across the long image dimension by the proportional number of pixels for the specific photo format; for example- 1500 pixels by 1200 pixels for 8"x10" or 4"x5" prints or negatives, 1500 pixels by 1000 pixels for 35mm slides or negatives or 4"x6" prints. For square images, files shall be reduced to 1340 pixels by 1340 pixels. Final image resolution for large access files shall be a default resolution of 150 dpi and the image size shall be 10" across the long dimension for rectangular images and 9"x9" for square images.

For documents LARGER than 11"x17" or 187 sq. inches, the images shall be resized from 200 dpi to a smaller image size using the following settings.

The image size shall be the size of the original document at a resolution as specified below; example- 20"x24" at 90 dpi:

90 dpi for 2.0 mm or larger character height.*

125 dpi for 1.5 mm character height.*

200 dpi for 1.0 mm or smaller character height.*

*Height of lower case character (usually lower case "e") of the smallest type size on the document.

Resizing:

The large access files shall be produced by resizing from the master image files; an interpolation algorithm that provides high quality results, such as bicubic interpolation, shall be used.

Blurring and Resharpening:

All files will be blurred prior to resizing using a blur filter. After resizing, all files shall be sharpened as needed to achieve the approximate appearance of the original. All sharpening shall be done with an unsharp mask algorithm.

See typical unsharp mask parameters cited above.

Tonal Scale and Color Balance:

Since the large access files are derived from the master files, there should not be a need for adjustments to the tonal scale or color balance, all adjustments should be done to the master image files. If any tonal scale and color balance adjustments are needed, the tonal scale and color balance shall be adjusted using "levels" control to produce a compromise setting for viewing on monitor set to a gamma of 2.2 and visually calibrated to the NARA Monitor Calibration Target.

Global adjustments using "brightness", "contrast", and "color balance" controls should not be used.

Color Palette and Dithering:

8 bit color files shall use a custom/adaptive 256 color palette generated from each individual image. All dithering shall be done using a diffusion dither algorithm and all dithering shall be performed after sharpening the image.

ACCESS FILES

Textual Documents-

Pixel Depth and File Format:

4 bit interlaced / 89a GIF files for 8 bit grayscale images or 8 bit interlaced / 89a GIF files for 24 bit color images for documents SMALLER than or EQUAL to 8.5"x14" or 119 sq. inches. Resize image to 90 dpi at original size and let GIF file default to 72 dpi at larger than original size.

8 bit grayscale JPEG for grayscale images or 24 bit color JPEG, RGB mode, for color images for documents LARGER than 8.5"x14" or 119 sq. inches in size. The image size shall be the size of the original document at the dpi specified below; example: 16.5"x20.5" at 90 dpi.

Image Size:

Images shall be resized from 300 dpi or 200 dpi master files to a smaller image size using the following settings-

90 dpi regardless of character height*.

OPTIONAL-

72 dpi for character height* of 1.5mm or larger.

90 dpi for character height* smaller than 1.5 mm.

*Height of lower case character (usually lower case "e") of the smallest type size on the document.

Photographs-

Pixel Depth and File Format:

4 bit interlaced / 89a GIF files for 8 bit grayscale images.

8 bit interlaced / 89a GIF files for 24 bit color images.

Image Size:

3000 pixel dimension of master files shall be reduced to 600 pixels across the long image dimension by the proportional number of pixels for the specific photo format; example: 600 pixels by 480 pixels for 8"x10" or 4"x5" prints or negatives, 600 pixels by 400 pixels for 35mm slides or negatives or 4"x6" prints. For square images, files shall be reduced to 540 pixels by 540 pixels.

Final image resolution for access files shall be a default resolution of 72 dpi.

Maps, Plans, and Oversized Records-

Pixel Depth and File Format:

8 bit grayscale JPEG for grayscale images or 24 bit color JPEG, RGB mode, for color images for documents. JPEG compression shall be set at low quality or approximately 20:1 or higher compression.

Image Size:

Files shall be resized to 1200 pixels across the long image dimension by the proportional number of pixels for the specific document; for example- 1200 pixels by 960 pixels for 16"x20" or 24"x30" documents, 1200 pixels by 800 pixels for 40"x60" documents. For square documents, files shall be reduced to 1070 pixels by 1070 pixels.

Final image size shall be set to a standard 10" across the long dimension at 120 dpi and square images shall be set to a standard 9"x9" at 120 dpi.

Graphic Records-

Pixel Depth and File Format:

4 bit interlaced / 89a GIF files for 8 bit grayscale images or 8 bit interlaced / 89a GIF files for 24 bit color images for documents SMALLER than or EQUAL to 11"x17" or 187 sq. inches.

8 bit grayscale JPEG for grayscale images or 24 bit color JPEG, RGB mode, for color images for documents LARGER than 11"x17" or 187 sq. inches in size.

Image Size:

For documents SMALLER than or EQUAL to 11"x17" or 187 sq. inches, the 3000 pixel dimension of master files shall be reduced to 600 pixels across the long image dimension by the proportional number of pixels at a default resolution of 72 dpi. For square images, files shall be reduced to 540 pixels by 540 pixels at a default resolution of 72 dpi.

For documents LARGER than 11"x17" or 187 sq. inches, files shall be resized to 1200 pixels across the long image dimension by the proportional number of pixels for the specific document; example: 1200 pixels by 960 pixels for 16"x20" or 24"x30" documents, 1200 pixels by 800 pixels for 40"x60" documents. For square documents, files shall be reduced to 1070 pixels by 1070 pixels.

Final image size shall be set to a standard 10" across the long dimension at 120 dpi and square images shall be set to a standard 9"x9" at 120 dpi.

OPTIONAL-

For documents LARGER than 11"x17" or 187 sq. inches, images shall be resized from 200 dpi master files to a smaller image size using the following settings and image size shall be the size of the original document at 72 dpi or 90 dpi-

72 dpi for character height* of 1.5mm or larger.

90 dpi for character height* smaller than 1.5 mm.

*Height of lower case character (usually lower case "e") of the smallest type size on the document.

Resizing:

The access files shall be produced by resizing from the master files, or the large access files if produced; an interpolation algorithm that provides high quality results, such as bicubic interpolation, shall be used.

Blurring and Resharpening:

All files will be blurred prior to resizing using a blur filter. After resizing, all files shall be sharpened as needed to achieve the approximate appearance of the original. All sharpening shall be done with an unsharp mask algorithm.

See typical unsharp mask parameters cited above.

Tonal Scale and Color Balance:

Since the access files are derived from the master files or large access files, there should not be a need for adjustments to the tonal scale or color balance, all adjustments should be done to the master image files. If any tonal scale and color balance adjustments are needed, the tonal scale and color balance shall be adjusted using "levels" control to produce a compromise setting for viewing on monitors set to a gamma of 2.2 and visually calibrated to the NARA Monitor Calibration Target.

Global adjustments using "brightness", "contrast", and "color balance" controls shall not be used.

Color Palette and Dithering:

8 bit color files shall use a custom/adaptive 256 color palette generated from each individual image. All dithering shall be done using a diffusion dither algorithm and all dithering shall be performed after sharpening the image.

THUMBNAIL FILES:**Textual Documents, Photographs, Maps, Plans, Oversized Records, and Graphic Records-****Pixel Depth and File Format:**

4 bit interlaced / 89a GIF files for 8 bit grayscale images.

8 bit interlaced / 89a GIF files for 24 bit color images.

Image Size:

Not to exceed a pixel array of 200 pixels by 200 pixels, at a default resolution of 72 dpi.

Resizing:

The thumbnail files shall be produced by resizing from the access image files; an interpolation algorithm that provides high quality results, such as bicubic interpolation, shall be used.

Blurring and Resharpening:

All files will be blurred prior to resizing using a blur filter. After resizing, all files shall be sharpened as needed to achieve the approximate appearance of the original. All sharpening shall be done with an unsharp mask algorithm.

See typical unsharp mask parameters cited above.

Tonal Scale and Color Balance:

Since the thumbnail files are derived from the access files there should be no need for adjustments to the tonal scale or color balance; all adjustments should be done to the master image files.

Color Palette and Dithering:

8 bit color files shall use a custom / adaptive 256 color palette generated from each individual image. All dithering shall be done using a diffusion dither algorithm and all dithering shall be performed after sharpening the image.

Quality Assurance Procedures

A quality control program shall be initiated, documented, and maintained throughout all phases of the digital conversion. The quality control plan shall address all specifications and reporting requirements associated with each phase of the conversion project.

The unit/partner/contractor shall be responsible for performing all inspections or evaluations of the quality of all digital images during production to ensure the quality of the digital images.

Reports

The unit/partner/contractor shall document all quality control procedures and actions taken and the following specific reports shall be submitted.

Quality Control Summary: The unit/partner/contractor shall provide a summary report of all quality control inspections performed for each batch of digital images produced. Report shall be submitted with the digital files.

INSPECTION AND ACCEPTANCE/REJECTION

Inspection of Digital Files

Electronic Access Project/Digital Imaging Project shall require one (1) to two (2) weeks for evaluating digital files, file name integrity, file header information, accuracy of tracking data, and completeness of the batch prior to acceptance. Upon completion or receipt of a batch of digital files, NARA will survey and evaluate a sampling of the digital images, including the master files, the access files, and the thumbnail files. The overall quality of the digital images will be evaluated using the following procedures.

At a minimum, 10 images or 10 % of each batch of digital images, whichever quantity is larger, shall be inspected for compliance with the digital imaging specifications and for any one of the following defects:

- image not the correct size
- image not the correct resolution
- incorrect file format
- incorrect mode, color image is a grayscale
- incorrect bit depth
- loss of detail in the highlights or shadows
- uneven tonal values or flare
- overall too light or too dark
- overall too low or too high contrast
- interference patterns (Newton's rings)
- lack of sharpness
- excessive sharpening, including unnatural appearance and halos around dark edges

- improper image orientation, such as backwards, up-side down, side-ways, etc.
- excessive noise, usually noticeable in the darker portions of the image
- misalignment of color channels in RGB images
- incomplete or cropped images
- excessively large border area
- image not centered or skewed images
- missing scan lines or dropped-out pixels
- image processing and scanner artifacts, such as extraneous lines, noise, banding, etc.
- dithering on master files or poor quality dithering on access or thumbnail files
- poor quality interpolation on small access files and thumbnail files
- overall color cast and inaccurate color balance
- improper file name
- incomplete or incorrect header information

The visual evaluation of the images shall be conducted while viewing the images at a 1 to 1 pixel ratio or 100% magnification on the monitor.

Testing Results and Acceptance/Rejection

If more than 1% of the total number of images in a batch, based on the randomly selected sampling, are found to be defective for any of the reasons listed above, the entire batch will be returned to the unit/partner/contractor for reinspection of the batch and correction of the specific errors found by NARA and any additional errors found by the unit/partner/contractor. If less than 1% of the batch is found to be defective, then only the specific defective images that are found shall be redone. The Electronic Access Project/Digital Imaging Project reserves the right to reinspect the batch when it is resubmitted.

Document Handling Guidelines

The following instructions provide guidance on the proper handling of archival materials for digitization.

1. Equipment

- a. The unit/partner/contractor shall not use automatic feed devices, drum scanners or other machines that require archival materials to be fed into rollers, that place more pressure on archival materials than does an oversized electrostatic copier, or require the document to be taped to a cylinder. The unit/partner/contractor may use automatic devices to digitize selected microfilm or other materials identified by the Electronic Access Project Team/NARA.
- b. The unit's/partner's/contractor's equipment shall have platens upon which physical items are supported over their entire surface. The unit/partner/contractor shall ensure that no equipment comes into contact with archival materials in a manner that causes friction.

- c. The unit/partner/contractor shall not use equipment having devices that exert pressure on or that affix archival materials to any surface. The unit/partner/contractor shall not affix pressure sensitive adhesive tape nor any other adhesive substance to any archival materials.
- d. The unit/partner/contractor should not use equipment with light sources that raise the surface temperature of the physical item being digitized. The unit/partner/contractor should filter light sources that generate ultraviolet light.
- e. The Electronic Access Project Team/NARA shall have the right to review and approve all equipment.

2. Procedures

- a. The unit/partner/contractor shall not leave archival materials unattended or uncovered on digitizing equipment or elsewhere. The unit/partner/contractor shall return archival materials left undigitized but needed for the next day's work to their jackets and containers and place them in the appropriate storage areas in the unit's/partner's/contractor's work area. The unit/partner/contractor shall return completed batches of archival materials to NARA staff in the unit's/partner's/contractor's work area.
- b. The unit/partner/contractor shall place archival materials flat on the platen; rolling, pulling, bending, or folding of archival materials is not permitted. The unit/partner/contractor shall place only one physical item at a time on a surface appropriate for the item's size and format, except when scanning 35mm slides in a batch mode on a flat-bed scanner. The item shall be supported over its entire surface on the platen; no part of an item shall overhang the platen so that it is unsupported at any time. The unit/partner/contractor shall not place archival materials that are warped, curling, or on warped and/or fragile mounts on the platen.
- c. The unit/partner/contractor shall unroll and rewind or roll up archival materials carefully (e.g., roll film, maps, etc.) as soon as the digitizing is finished. The unit/partner/contractor shall rewind any rolls of film with the emulsion side in. The unit/partner/contractor shall rewind or reroll archival materials in the same orientation as originally rolled.
- d. The unit/partner/contractor shall handle archival materials in bound volumes carefully and not force them open or place them face down. The unit/partner/contractor shall use book cradles to support volumes.
- e. The unit/partner/contractor shall not remove encapsulated archival materials from their encapsulation. The unit/partner/contractor may remove L-sleeves designated by NARA staff.
- f. The unit/partner/contractor shall report archival materials which in his or her judgment cannot be safely digitized and seek further guidance from the Electronic Access Project Team/NARA staff before proceeding with digitizing.

- g. The unit/partner/contractor shall keep all archival materials in their original order and return them to their original jackets or containers. The unit/partner/contractor shall reinsert all negatives removed from jackets in proper orientation with the emulsion side away from the seams. The unit/partner/contractor shall keep any tracking paperwork with the archival materials or their containers.
- h. The unit/partner/contractor shall not smoke, drink, or eat in the room where archival materials or their containers are located. Unit/partner/contractor staff shall clean their hands and avoid the use of hand lotions before working with archival materials. The unit/partner/contractor shall not bring tobacco, liquids, and food into the room where archival materials or their containers are located.
- i. The unit/partner/contractor shall not place objects such as books, papers, pens, and pencils on archival materials or their containers. The unit/partner/contractor shall use only lead pencils as writing implements near archival materials or their containers. The unit/partner/contractor shall not write on or otherwise mark archival materials, jackets, or containers.
- j. The unit/partner/contractor shall not lean on, sit on, or otherwise apply pressure to archival materials or their containers.
- k. Unit/partner/contractor staff shall wear clean white cotton gloves at all times when handling archival materials. The unit/partner/contractor shall provide gloves.
- l. The Electronic Access Project Team/NARA staff shall have the right to inspect, without notice, the unit/partner/contractor work areas and digitizing procedures or to be present at all times when archival materials are being handled. Units/partners/contractors are encouraged to consult the Electronic Access Project Team/NARA staff for clarification of these procedures or when any difficulties or problems arise.

3. Training

- a. Training may be provided by Preservation Programs, NWT, for archival material handling and certification of unit/partner/contractor staff. Any new unit/partner/contractor staff assigned to this project after the start date shall be trained and certified before handling archival materials.